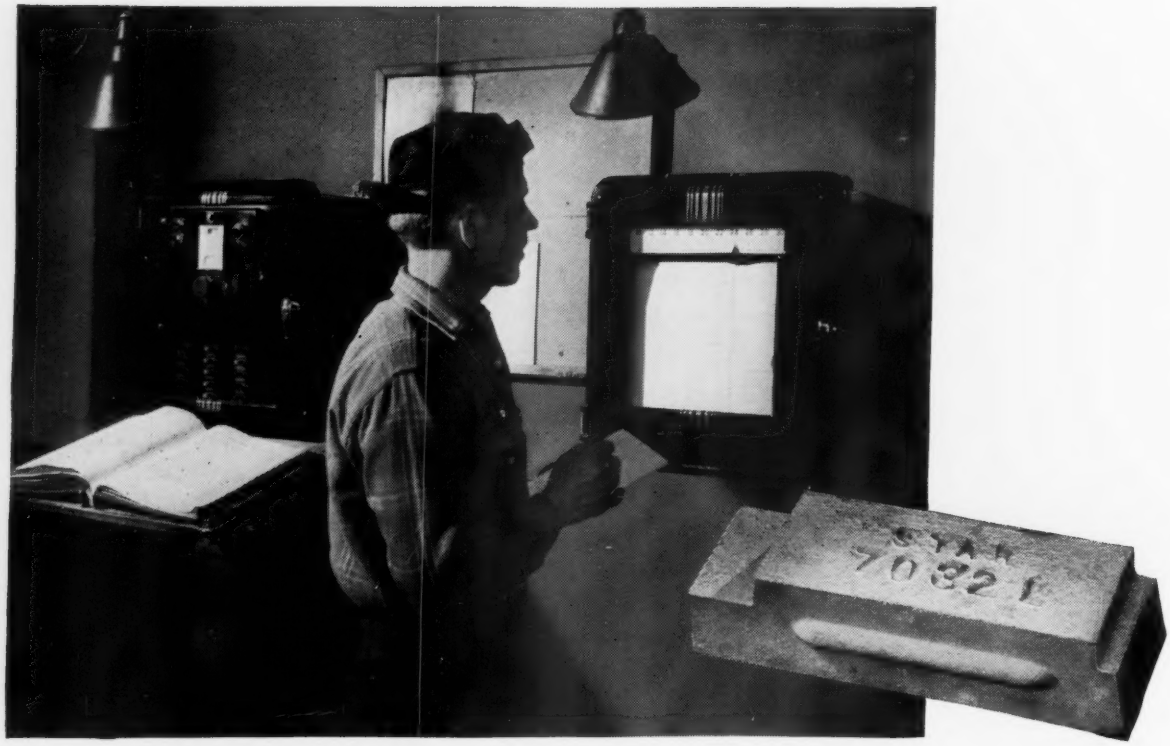
CERAMIC ABSTRACTS and THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

JUNE 15, 1944

MONTHLY PUBLICATION DEVOTED TO THE ARTS AND SCIENCES RELATED TO THE SILICATE INDUSTRIES



(Above) A ware burner in Harbison-Walker Refractories Co.'s E. Chicago plant; (right) one of the silica brick produced there. Burner is logging temperatures of 6 platinum thermocouples accurately recorded by Micromax Pyrometer. Behind him is a double-range L&N Indicator for reading these temperatures and any of the fourteen base-metal couples in preheat and cooling zones. Quality of silica brick is especially dependent on highly accurate measurement of temperature, by these L&N instruments.

SILICA BRICK TEMPERATURES Checked With MICROMAX PYROMETERS

A pyrometer setup which lets the wareburner read the temperature almost anywhere in the tunnel kiln—at any time—is used in Harbison-Walker's 516-foot kiln shown above, where temperature is particularly important. But the dependability and accuracy which make Micromax Pyrometers suitable for this exacting job can be applied *in the same way* to any tunnel kiln, and should of course pay dividends in burning any ware.

For at and near the critical points the Micromax quality which we call micro-responsiveness is very valuable. It records changes so tiny that a man would otherwise miss them; and, by catching them when they're tiny, gives ample warning.

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This is *modern* recording and controlling—the kind which assures good products and low costs. If you will outline a problem to which such an instrument could apply, an L&N engineer will either talk it over with you, or send a Micromax catalog, as you prefer.

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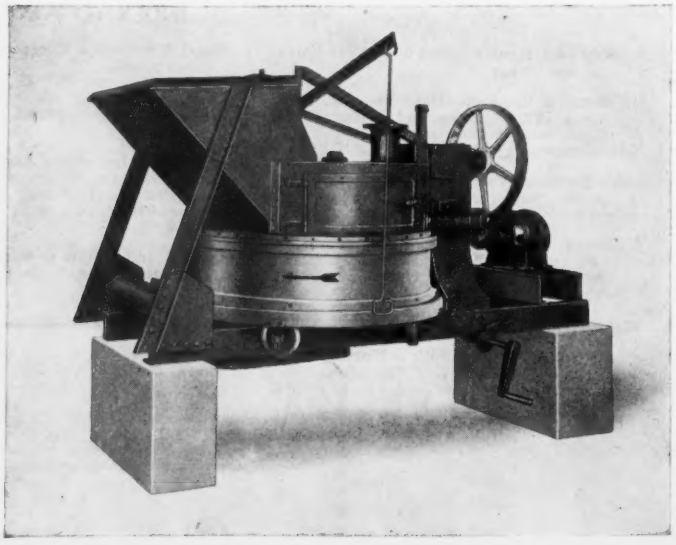
*"Lancaster" Mixers are unexcelled for dry mixing electrical porcelain bodies—also in preparations for steatite and mycalex products.



"Lancaster" Mixer, Symbol EMG. Closed pan type, fitted with full batch stationary hopper.

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The facility of "Lancaster's" central discharge valve permits employing any type of equipment for receiving mixed batches that best suit the requirements of the installation.

(Left) The central discharge valve in closed position. This valve is approximately one-third the diameter of the pan.

(Right) The central discharge valve fully opened. Note the absence of any working parts in the path of the discharged batch.

"Lancaster" Mixers are being successfully used for more than 30 diversified mixing processes including precision formulas for:

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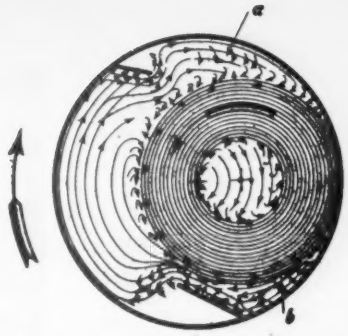
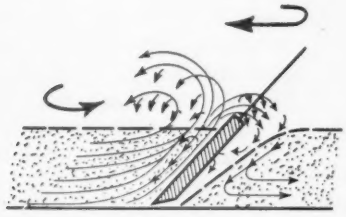
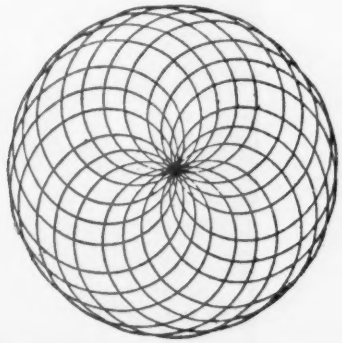


Material conveyed by the pan in clockwise direction at moderate velocity is diverted by a stationary side scraper plow into the narrow trough at "a." It is picked up by the counter-clockwise rotating mixing tool equipment, set off-center of the mixing pan. Material leaving the whirlpool at "b" is picked up by the stationary bottom plow. Countless crossing-over points are created by this ever-changing activity . . . turning, dividing and dispersing the entire batch with each revolution of the pan.



The stationary bottom plow is shown turning material around its horizontal axis, in waves, bringing bottom layers to the top.



These curves clearly illustrate the paths covered by mixing tools during one revolution of the pan.

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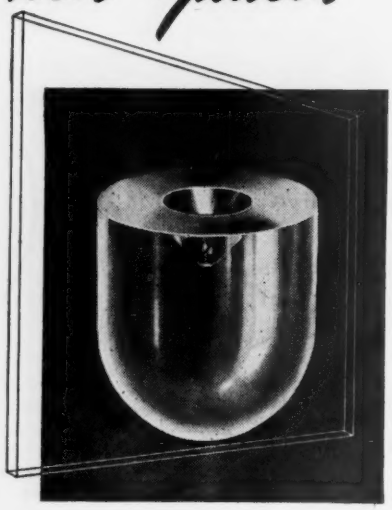

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During 1944 Armco national advertising will appear in *The Saturday Evening Post, Time, Newsweek, the Farm Journal* and *Successful Farming* — reaching a total of nearly nine million families. It tells these families that Armco *special purpose metals* will again insure basic metal quality in the products you will make after the war. This advertising should pay dividends to both of us.

When peace comes you can again use ARMCO Enameling Iron — long known for its uniformity, adherence and sag-resistance — in making these urgently needed civilian products. Meanwhile, we may be able to help you now — by working with your product-and-materials men on new ideas and developments. Our long experience and laboratory facilities are at your disposal. . . . The American Rolling Mill Company, 931 Curtis Street, Middletown, Ohio.

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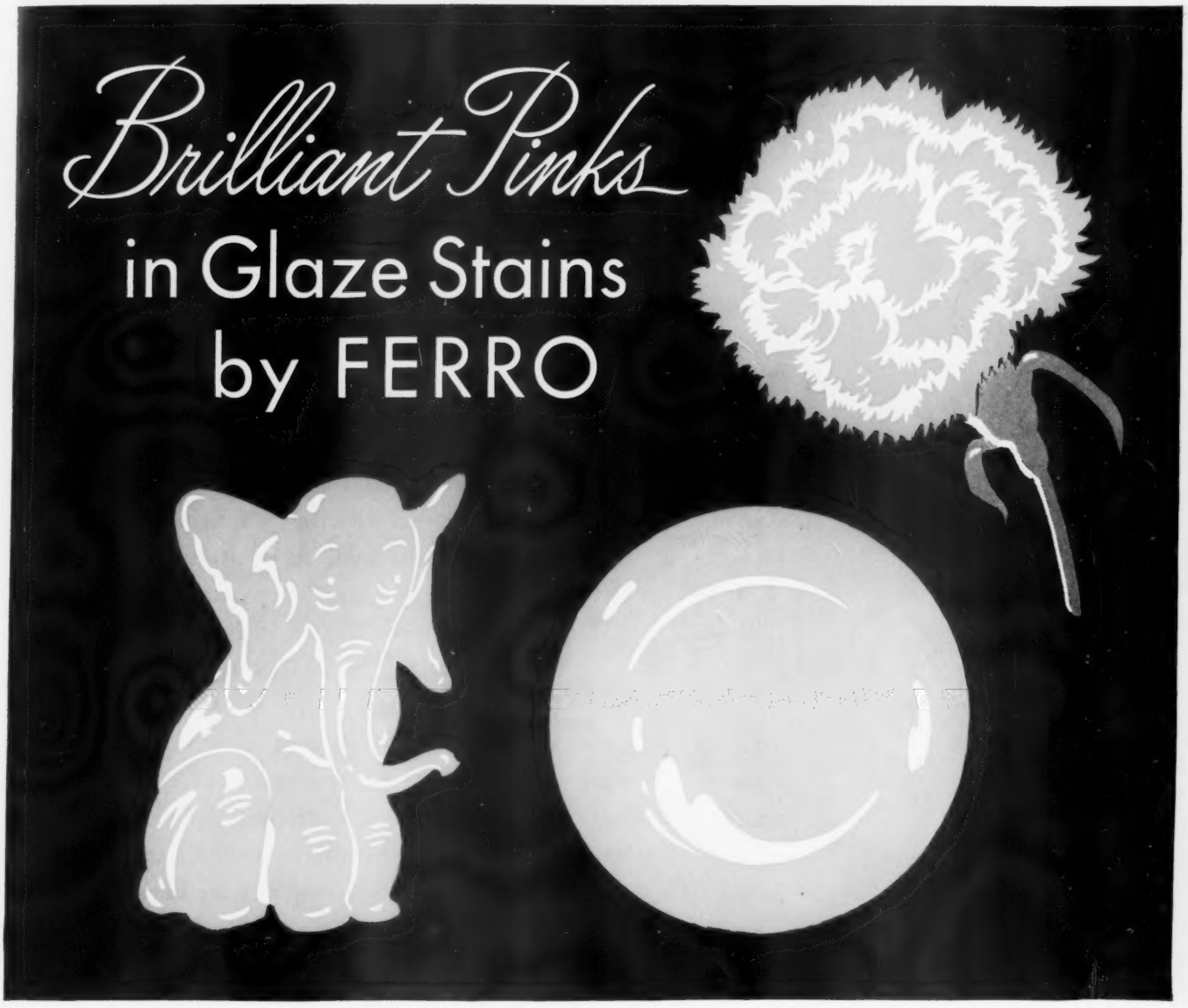

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Write today for full information. Or better yet, send us samples of colors you would like us to match. In fact, we are prepared to match practically *any color . . . in glaze stains, body stains, overglaze colors or underglaze colors.*

Porcelain Enamelers and Glass Manufacturers with color problems are *also* invited to put their problems up to us. If there's a solution, we believe we'll find it. Suppose you tell us about it! No obligation, of course.

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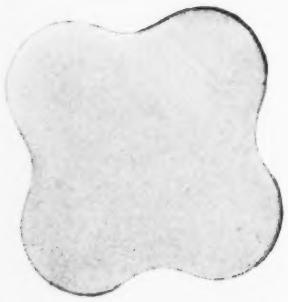

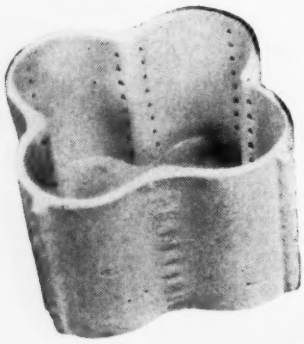

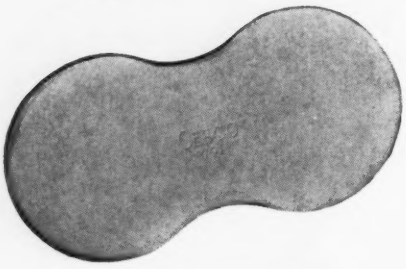

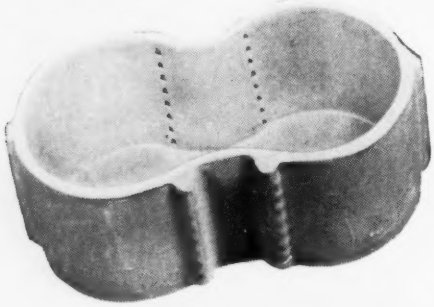

If you are looking for more *durable* kiln furniture—real tough, rugged, *thin-walled* refractories that will help reduce fuel bills and, incidentally, increase the "payload" capacity of your kilns—you'll find it here at CESCO, and in a wide variety of sizes and shapes.

CESCO Saggers, due to the development of new refractory formulas and close laboratory control at each stage of production, have exceptional strength for their weight. That's why walls and bottoms can be made thinner, *safely*. This, in turn, permits you to fire more ware in each loading, with substantial savings in time, fuel and money.

Highly resistant to thermal shock, CESCO Refractories have unusually long life. But, suppose you *try* them . . . and *prove these facts* for yourself.

In our two modern plants, we have ample capacity to meet your requirements promptly and fully. How and when may we serve you?

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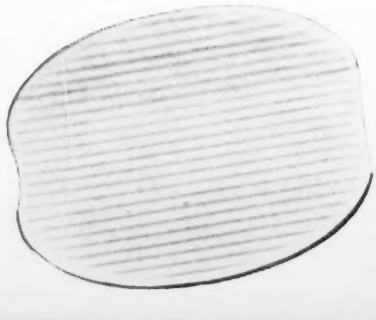

HEAVY DUTY REFRACTORIES FOR THE CERAMIC INDUSTRY

For enameling furnaces and ceramic kilns of all types Norton Company manufactures a complete line of super refractories—ruggedly designed for long service under severe operating conditions.

ALUNDUM (Al_2O_3) Muffle Plates for enameling furnaces are chemically inert and so physically rugged that they can be made thin to transmit heat rapidly from source to ware. The patented Manion "V" bottom, made of ALUNDUM plates, presents 50% more radiation surface than is obtained with either a flat bottom or an arch bottom muffle.

CRYSTOLON (SiC) Batts, designed with a patented slotted construction, are resistant to cracking from high temperature stresses. They will not spall or become deformed under heat and are strong enough to be made with thin cross-section for economical use. CRYSTOLON car tops, ALUNDUM saggers and other kiln furniture by Norton give exceptionally long service.

The Norton Corrugated Plate, made of ALUNDUM, successfully replaces rectangular plates of much greater thickness in tunnel kilns and enameling furnaces. The corrugations give great strength to the plate and the thin section of the corrugation allows much more rapid heat transfer and reduces the weight of the plate. Naturally the radiating surface is materially increased.

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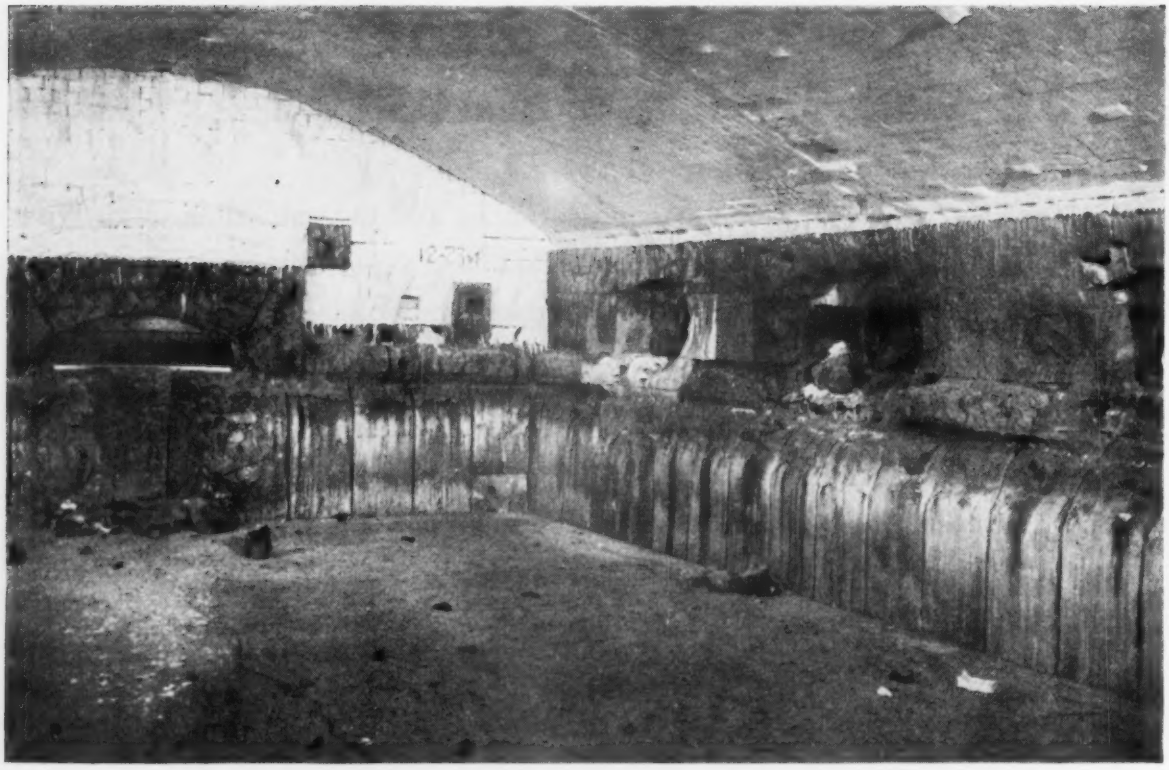

ANOTHER INTERESTING CORHART REPORT

LAST month we published four pictures of a Corhart* Electrocast tank which had run 1199 days and produced 104,890 tons of flint and amber glass (153.3 tons produced per square foot per life).

We thought you might want to study the detailed figures. So here they are:

TOTAL DAYS LIFE	1199
TOTAL IDLE DAYS	48
TOTAL OPERATING DAYS	1151
TOTAL TONS GLASS PRODUCED (FLINT AND AMBER)	104,890.78
AVERAGE DAILY TONNAGE LIFE	87.48
AVERAGE DAILY TONNAGE OPERATING DAYS	91.13
SQ. FT. PER TON LIFE	7.82
SQ. FT. PER TON OPERATING DAYS	7.50
TONS PRODUCED PER SQ. FT. PER LIFE	153.35

This furnace was built of Corhart Electrocast throughout the melting and refining-end sidewalls, throat, doghouse and breastwalls, plus outer course bottom blocks in the melting and refining ends, and a section of bottom in front of the doghouse. All blocks were Corhart Standard except the throat, several superstructure shapes and two melting-end sidewall blocks beneath the No. 1 port, which were Corhart Zed. (Note the two Zed sidewall blocks shown in the photograph). The furnace operated approximately four months on flint bottle glass, after which it was changed over to amber.

The furnace *did not fail.* No patch blocks or waterjackets were used at any time on Corhart materials. At the conclusion of the campaign it was found that the furnace could have been operated for several additional months.

Corhart Refractories Company, *Incorporated,* 16th and Lee Streets, Louisville 10, Kentucky.

*Not a product, but a registered trade-mark.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

Ceramic Abstracts Section

Compiled by

THE AMERICAN CERAMIC SOCIETY

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Vol. 23 **June 15, 1944** **No. 6**

Abrasives

*** Ceramically bonded corundum abrading wheels with low melting, particularly phosphatic, binders.** R. RIEKE AND C. HAEBERLE. *Ber. Deut. Keram. Ges.*, **24** [4/5] 117–44 (1943).—The purpose of this investigation was to determine the effect of the bonding material on the properties of abrading wheels. Ten compositions of binders were tested. The binders were tested separately, and then abrading wheels bonded with 15, 20, and 25% of the bonding compositions were studied. The abrading wheels were tested for their hardness, elasticity, transverse and tensile strengths, and resistance to pressure and to shock. The primary concern was to determine the effect of the P_2O_5 and Al_2O_3 contents. The tests carried out with the bonding compositions showed that P_2O_5 acts as a flux and lowers the melting point. Small quantities of P_2O_5 lower the coefficient of expansion. With increasing quantities of P_2O_5 the coefficient of expansion goes through a minimum and then rises again. When mixed with corundum, all the binders showed a coefficient of expansion closely resembling that of corundum. The hardness of the abrading wheels was determined primarily by the amount of binder in them. There were differences, however, between equal quantities of binder. Wheels to which Al_2O_3 was added in addition to the frit were the least hard. P_2O_5 has only a slight effect on hardness. $Zn_3(PO_4)_2$ seemed to raise the hardness somewhat. The modulus of elasticity is affected but insignificantly by P_2O_5. No proportionality between the two could be observed. The effect of P_2O_5 on pressure resistance and transverse and tensile strengths is insignificant. $Zn_3(PO_4)_2$ improved these indices. The best transverse shock resistance was observed in mixes from which P_2O_5 was omitted. A comparison of the tested wheels with commercial abrading wheels fired at high temperatures showed that there is no particular advantage in high-temperature firing. The experimental wheels were not inferior in quality to the high temperature fired commercial wheels; in some respects they surpassed the commercial abrading wheels. The authors dispute U. S. Pat. 1,987,861 ("Ceramic . . . ," *Ceram. Abs.*, **14** [4] 85 (1935)). The ameliorating effect on abrading wheel mixes is attributed to B_2O_3 rather than to P_2O_5. M.Ho.

* Obtained from microfilm.

Diamond shortage in Germany. Substitute truing tools. ANON. *Ind. Diamond Rev.*, **4** [38] 4–9 (1944).—In Germany the truing of grinding wheels is at present the most urgent problem in the grinding room. Because of the forces acting during truing, the ideal shape of the truing point can be provided only by a diamond. Numerous tests were made without the diamond, but none was quite successful; steel is not sufficiently wear resistant to stand the stress, but ceramic rollers are successful where surface finish of the ground work is considered. In spite of the good results and favorable shape of sintered carbides, a considerable use of them in Germany is impossible owing to the scarcity of the hard metal. Conclusions are as follows: (1) The truing device must be fixed rigidly in the machine, considering the forces exerted. (2) The feed of the machine table should be about 6 ft. per min. with ceramic tools and only 1.5 to 4.5 ft. per min. with metallic tools. The cutting depth per pass must be selected according to the truing tool, i.e., the softer the material of the truing wheel, the less is the cutting depth. (3) Large cutting depth without running out of the wheel gives only a coarsely ground surface; small cutting depths improve the structure of the grinding wheel and therefore the surface finish of the wheel. (4) During truing, the truing wheel must attain and keep the speed of the grinding wheel. (5) The number of passes along the grinding-wheel face is influenced by the wear of the truing wheel. (6) The coolant supplied to the grinding wheels favorably influences the truing process. (7) The truing wheel must run clearance free. (8) Each grinder should be trained to be familiar with nondiamond truing tools as well as with diamond tools. Many illustrations, a bibliography, and a table are given. ABSTRACTER'S NOTE: Much of this article is abstracted from "Truing . . . ," this page. P.G.

Modern abrasives. H. C. COOPER. *Jour. Chem. Education*, **19** [3] 122–27 (1942).—The production, application, and uses of three modern abrasives, SiC, fused Al_2O_3, and B_4C, are discussed in detail. S.Z.

Truing grinding wheels. W. VITS AND H. STARCK. *Tech. Z. prakt. Metallbearbeitung*, **53**, 49–54 (1943); see "Diamond. . . ," this page. P.G.

BOOK

Machinery's Handbook. 12th ed. Reviewed in *Machinery* [N. Y.], **50** [4] 224 (1943). R.H.B.

PATENTS

Abrasive article. R. H. LOMBARD (Norton Co.). Can. 418,316, Feb. 8, 1944 (Nov. 26, 1942; in U. S. Jan. 22, 1942). G.M.H.

Abrasive-coated articles. A. ABBEY (Carborundum Co.). Brit. 559,943, March 22, 1944 (Jan. 23, 1942).

Abrasive element. E. W. COLT, L. B. LANE, AND J. L. BEATTY (Armour and Co.). U. S. 2,347,244, April 25, 1944 (Dec. 7, 1942).—A strip of pile fabric having an interwoven base and pile filaments extending upwardly therefrom.

Abrasive manufacture. R. P. CARLTON (Minnesota Mining & Mfg. Co.). Can. 419,239, March 21, 1944 (Dec. 30, 1932). G.M.H.

Abrasive material. R. L. MELTON AND R. C. BENNER (Carborundum Co.). Can. 418,564, Feb. 22, 1944 (Aug. 27, 1942; in U. S. Dec. 29, 1941). G.M.H.

Abrasive and method of making. R. C. BENNER AND F. A. UPPER (Carborundum Co.). U. S. 2,347,537, April 25, 1944 (June 12, 1941; July 29, 1942).—The process of making an abrasive polishing material which comprises forming a fusion of alumina, atomizing the molten alumina of the fusion, quenching the atomized alumina to form separate shotlike alpha-alumina bubbles, and, without further treatment which substantially changes the chemical composition of the bubbles, crushing the thus-formed bubbles to form a mass of particles consisting predominantly of separate rhombohedral crystals and pyramidal fragments thereof.

Abrasive wheel. J. C. MAYS (Carborundum Co.). U. S. 2,347,920, May 2, 1944 (March 27, 1941).—An abrasive cut-off wheel.

Bar-grinding apparatus. S. A. PLATT (Wilbur B. Driver Co.). U. S. 2,347,503, April 25, 1944 (Aug. 27, 1943). U. S. 2,347,639, April 25, 1944 (Nov. 24, 1942).

Device for grinding straight edges on planer cutter blades. H. E. SJÖSTRAND. U. S. 2,347,800, May 2, 1944 (Aug. 25, 1941).

Diamond abrasive stick. ADOLPH EHRLICH. U. S. 2,347,597, April 25, 1944 (Aug. 26, 1943).

Diamond dressing tool and method of determining diamond sizes therefor. J. L. PETRIE (Wheel Trueing Tool Co.). U. S. 2,347,280, April 25, 1944 (July 12, 1941).—The method of dressing abrasive grit grinding wheels of the class having abrasive grits of a size not appreciably coarser than size 30 nor finer than size 120 with a plurality of small diamonds which comprises determining the grit size of each wheel to be dressed, selecting substantially uniformly sized diamonds within a size range of 0.0225 to 0.1975 carat in accordance with the grit size of the wheel to be dressed.

Dressing device for grinding wheels. JOHN WELSAND, JR., AND L. L. LEE (Eaton Mfg. Co.). U. S. 2,346,528, April 11, 1944 (June 5, 1942).

Gear crowning. R. S. DRUMMOND. U. S. 2,347,998, May 2, 1944 (April 28, 1941).

Grinding machine. O. R. BRINEY, JR. U. S. 2,347,766, May 2, 1944 (May 21, 1942).

Means for dressing grinding wheels. W. F. ROSS. U. S. 2,347,283, April 25, 1944 (June 3, 1940); divided out of U. S. 2,307,238, Jan. 3, 1943 (Oct. 30, 1939).

Method and apparatus for grinding molds. W. A. MONTGOMERY (U. S. Pipe and Foundry Co.). U. S. 2,346,861, April 18, 1944 (June 7, 1943).

Polishing machine. H. R. COSTLEY (Nash-Kelvinator Corp.). U. S. 2,347,029, April 18, 1944 (March 23, 1942).—A machine for polishing the cylindrical valve-engaging surface of a rocker arm.

Radius grinder. W. F. STEPHENSON. U. S. 2,347,616, April 25, 1944 (Nov. 14, 1941).

Resin bonded abrasive sheet material. R. P. CARLTON AND B. J. OAKES (Minnesota Mining & Mfg. Co.). U. S. 2,347,662, May 2, 1944 (Jan. 27, 1934).

Art and Archeology

American Ceramic Society—Report of Design Division officers. THEODORE LENCHNER, *Vice-Chairman*. *Bull. Amer. Ceram. Soc.*, **23** [5] 171–72 (1944).

Color nomenclature in qualitative analysis: I, Inter-Society Color Council nomenclature. L. P. BIEFELD AND M. GRIFFING. *Jour. Chem. Education*, **19** [6] 282–86 (1942).—The need for precise color designation in science is emphasized, and the characteristics of a good color nomenclature are described. A system designated as ISCC-NBS (Inter-Society Color Council-National Bureau of Standards) has been made available through the efforts of a group of scientific societies especially interested in color problems. The history and composition of this council of societies is outlined. The system, based on the Munsell Color System (*Ceram. Abs.*, **20** [3] 62 (1941)), designates color as perceived by the observer and related to a psychological color solid. A color can be uniquely described by three attributes—lightness, saturation, and hue. Lightness, represented by the vertical axis of the color solid, distinguishes between light and dark color. Saturation or chroma, represented by the horizontal axis of the solid, distinguishes bright from gray colors. Hue, represented by the angle about the vertical axis on the horizontal plane, distinguishes one color from another (based on the dominant reflected or transmitted wave length). When numerical values are assigned to the three attributes, a color can be catalogued. A Munsell color book (*ibid.*, **23** [4] 68 (1944)) is available for standardization. The Munsell system was later modified by the council, and color names were adopted. **II, ISCC-NBS color names.** *Jour. Chem. Education*, **19** [7] 307–11 (1942).—Names of colors of many inorganic and organic precipitates and colored liquids common to qualitative analysis are given according to the ISCC-NBS system. 16 references. See *Bull. Amer. Ceram. Soc.*, **22** [9] 306–10 (1943). S.Z.

Dating the Hissar sequence. S. PIGGOTT. *Antiquity*, **17** [68] 169–82 (1943).—The Hissar prehistoric pottery is found in Iran, but similiar pottery is found in northern India (Baluchistan), the animal ornament in both being decisive. Hissar pottery has considerable priority over Harrapa pottery, which does not antedate the early dynastic Sumerian pottery. The parallel cultures appear to be as follows:

Iran	India
Hissar I	Zhob culture
Hissar II	Harrapa culture
Hissar III	Jhukar culture

Illustrations and brief descriptions of the pottery are included. A.B.S.

Mexican potters retain ancient art introduced by Spanish monks. ANON. *Ceram. Ind.*, **42** [2] 60–64 (1944).—The production of old Spanish potteries in Mexico is described. The introduction of modern methods has begun but is making little headway. H.T.

Originality of California ceramics promises permanent markets. ANON. *Ceram. Ind.*, **42** [3] 35–36 (1944).—Characteristic ceramic ware produced in California is gaining rapidly in trade reputation. Local raw materials are used, and the ware is fired at low temperatures. Production includes fine dinnerware, hotel ware, sanitary ware, steatite insulators, etc. Illustrated. H.T.

Overbeck Pottery. ANON. *Bull. Amer. Ceram. Soc.*, **23** [5] 155–58 (1944).—Illustrated.

Permanent ceramic gallery—Blumenthal museum display. ANON. *Ceram. Ind.*, **42** [4] 105–108 (1944).—A permanent gallery of American ceramics has been opened by the Brooklyn (N. Y.) Museum. At the Metropolitan Museum of Art, New York, a temporary exhibit of the George Blumenthal collection of ceramics is being shown. Illustrated. H.T.

Plant practices are different in California. ANON. *Ceram. Ind.*, **42** [4] 84–86 (1944).—Bodies are fired at cone 04 to 4. Large amounts of talc are used in bodies with glass fluxes to lower the vitrification temperature. Kilns are usually small. H.T.

Still big buying, still nothing new at Los Angeles, Chicago shows. ANON. *Ceram. Ind.*, **42** [3] 54–58 (1944).—Ceramic products shown at the two gift shows are described. Illustrated. H.T.

PATENTS

Drinking glass design. ALEXANDER F. RICHARDS. Can. 13,634, Feb. 15, 1944. G.M.H.

Fish bowl design. A. F. RICHARDS. Can. 13,636, Feb. 15, 1944. G.M.H.

Footed casserole design. H. I. KLEINBERG. U. S. 137,794, May 2, 1944 (Feb. 12, 1944).

Plate design. ALFRED DUHRSSEN. U. S. 137,675, April 18, 1944 (Jan. 27, 1944). U. S. 137,728 and 137,729, April 25, 1944 (Jan. 27, 1944). U. S. 137,793, May 2, 1944 (Jan. 15, 1944).

Semiporcelain design. MYOTT SON & CO., LTD. Can. 13,625 to 13,627, Feb. 8, 1944. G.M.H.

Water pitcher design. A. F. RICHARDS. Can. 12,635, Feb. 15, 1944. G.M.H.

Cements

* **Calculating cement mixes.** HANS KÜHL. *Zement*, **32** [9/10] 81–89 (1943).—K. gives a mathematical presentation of a method for calculating the quantity, weight, or volume of individual components for obtaining a definite mix. The method of calculation is applicable for 2, 3, and 4 components. It is explained in detail, and formulas are given. M.Ho.

* **Calculation of mixtures.** HANS HEIN. *Zement*, **32** [5/6] 43–50 (1943).—A method is worked out for calculating mixtures and the properties of the resulting product. Let A_1, A_2, A_3, A_4 . . . be the components of a mixture. In the mix they are present in k_1, k_2, k_3, k_4 . . . parts by weight; p_1, p_2, p_3, p_4 . . . are the weights % of the desired substance in the individual components, and p_m is the weight % of the sought component in the mix. It follows that $k_1p_1 + k_2p_2 + k_3p_3 + \ldots = (k_1 + k_2 + k_3 + \ldots)p_m$. Thus $p_m = \dfrac{k_1p_1 + k_2p_2 + k_3p_3 + \ldots}{k_1 + k_2 + k_3 + \ldots} = \dfrac{\Sigma k \cdot p}{\Sigma k}$. By analogy in terms of volume, $p_m = \dfrac{\Sigma v \cdot p}{\Sigma v}$. If the specific gravity is designated by s or the density by d, then $s_m = \dfrac{\Sigma k}{\Sigma(k/s)}$ and $d_m = \dfrac{\Sigma k}{\Sigma(k/d)}$; also $s_m = \dfrac{\Sigma s \cdot v}{\Sigma v}$ and $d_m = \dfrac{\Sigma d \cdot v}{\Sigma v}$. Similarly $q_m = \dfrac{\Sigma q \cdot v}{\Sigma v}$, where q is the sought substance in grams per liter. Samples of calculations are given. A case is considered where the volume contracts when two liquids are mixed, e.g., H_2SO_4 and H_2O. For the preparation of a cement mix, certain corrections should be introduced. These are explained. A graphical method for solving mixing problems is described. M.Ho.

* **Experiences in homogenizing raw cement in cement plants.** CARL SIMONIS AND HANS HORN. *Zement*, **32** [15/16] 164–67 (1943).—Plant practices are recounted. M.Ho.

Gypsum in the sulfate recovery process. T. T. COLLINS, JR., H. J. HOTZ, AND E. WIBERG. *Paper Trade Jour.*, **114** [19] 39–41 (1942).—A survey is made of some of the historical, theoretical, and practical aspects of the use of gypsum in the sulfate recovery process. W.R.B.

* **Identification of clinker components in transmitted and incident light.** F. GILLE. *Zement*, **32** [1/2] 1–10 (1943).—The preparation of specimens, powdered or thin sections, for the microscopic examination of cement clinker is described. The characteristic behavior of clinker minerals under the microscope is tabulated. 37 references. M.Ho.

* **Optical analyses of cement.** W. GRAF CZERNIN AND M. BALDERMANN. *Zement*, **32** [15/16] 153–58 (1943).—The authors describe a method for making cement thin sections suitable for microscopic analysis. Plexigum M (a Röhm and Haas product) is used as the embedding substance. This substance is refluxed on an oil bath at 125° to 130° until it is of sirupy consistency. Seven parts of the prepared Plexigum M is mixed with 4 parts of cement on a glass plate. While mixing, hot air is blown on the mix to volatilize volatile components. The mixture is stirred and then kneaded. When ready, the mass is made into a ball 1.5 cm. in diameter. This ball is placed between 2 glass plates; on the upper plate is placed a 500 gm. weight, and the whole is kept in an oven for 48 hr. at 60°. Then the temperature is raised to 105° for 1 hr. The ball is ground with increasingly finer emery cloth, and finally, the section is polished and etched. For etching, a mixture of 1 part of concentrated HNO_3 in 100 parts of isoamyl alcohol is used. Full details are given. The results of the microscopic analyses of the thin sections are as dependable as those of chemical analyses. M.Ho.

Portland cement and the "plastic" concrete. R. H. BOGUE. *Jour. Chem. Education*, **19** [1] 36–42 (1942).—B. reviews the history and technology of cement with emphasis on modern developments and applications. S.Z.

PATENTS

Cement mixture plasticity increasing method. R. B. BOOTH (American Cyanamid Co.). Can. 418,998 and 418,999, March 14, 1944 (April 3, 1941; in U. S. May 2, 1940). Can. 419,276, March 28, 1944 (April 9, 1941; in U. S. May 21, 1940). G.M.H.

Portland cement composition. R. B. BOOTH (American Cyanamid Co.). Can. 419,133, March 21, 1944 (Feb. 16, 1942; in U. S. March 20, 1941). Can. 419,134, March 21, 1944 (Feb. 18, 1942; in U. S. March 20, 1941). Can. 419,135, March 21, 1944 (March 12, 1942; in U. S. March 20, 1941). G.M.H.

Portland cement mixture plasticity increasing method. R. B. BOOTH (American Cyanamid Co.). Can. 419,132, March 21, 1944 (April 12, 1941; in U. S. May 23, 1940). G.M.H.

Pozzuolanic materials and method of making. MARIO PALMIERI AND A. J. BECK (one-half to Sanitary District of Chicago). U. S. 2,346,451, April 11, 1944 (Nov. 12, 1938). —A material of manufacture having a high degree of pozzuolanic activity comprising a mixture of 90 to 99.5% argillaceous material and 10 to 0.5% monovalent alkali material of the group consisting of sodium chloride, sodium sulfate, sodium carbonate, sodium silicate, sodium acetate, sodium borate, potassium chloride, potasium sulfate, potassium carbonate, potassium silicate, potassium acetate, sodium hydroxide, and potassium hydroxide, the material being the resultant product of heating the mixture to a temperature slightly below the coalescing temperature.

* Obtained from microfilm.

Enamel

Enamel company will apply war methods to postwar improvements. ANON. *Ceram. Ind.*, **41** [6] 45–47 (1943).—The Republic Stamping & Enameling Co., Canton, Ohio, is continuing enameling on a limited scale while converting part of the furnace capacity to the heat-treating of steel parts. Illustrated. H.T.

Porcelain enamel in the postwar enamel industry. ROBERT A. WEAVER. *Bull. Amer. Ceram. Soc.*, **23** [5] 181–83 (1944).

Reduction in postwar enameling costs. BURTON SWEELY AND WAYNE DUVAL. *Better Enameling*, **15** [2] 5–6, 20; [3] 5–6 (1944).—Correct design of the article to be enameled is essential; no added manufacturing costs result, and in many cases decided economies in fabrication have been realized. The chief factors influenced by design are hairlines, warpage, and chipping. Lubricants applied during fabricating operations are often difficult to remove. The use of easily removed drawing compounds would justify any changes in dies that may be required to permit their use. The alkali cleaning bath should be more carefully controlled. Hot and cold rinses should be used. The wide variations in the rate of attack of steel in the acid bath can be avoided to some extent through proper control at the steel mill. The removal of acid and iron salts from the ware is essential to successful enameling operation. The use of a nickel bath is becoming more extensive as a means of improving enamel firing range. Fifty per cent of enamel rejections have been found to be due to faulty cleaning and pickling. A 50% reduction in rework results in a savings of 3.53% in actual enameling operations; additional savings would result from less chipping in subsequent operations or in actual use. B.C.R.

Silicate cements in acid tanks and how to use them. JOSEF M. ROBITSCHEK. *Brick & Clay Record*, **104** [2] 43–45 (1944).—Failure of acid tanks is generally due to the acidproof cement, as the best cement is more susceptible to chemical attack than even a medium-quality acidproof brick. Sodium silicate, sulfur, and resin cements are the most common, sodium silicate being the only one capable of withstanding temperatures above 180°C. in contact with acid or strongly oxidizing agents. The setting of sodium silicate cements depends on the evaporation of water; CO_2 may accelerate gelation or set. The process of setting and hardening may be hastened either by heating the structure or by the application of concentrated H_2SO_4. The latter method is usually followed. In quick-setting silicate cements, the addition of accelerators results in a considerable loss in strength. Amorphous silica, soluble in alkali solutions, occurs in nature as opal, chalcedony, etc.; it is used to replace the inert sand added as fillers. Cements thus prepared set quickly throughout the whole joint. In the production of superphosphate, a by-product of a precipitated reactive silicic acid is formed. This material used as a filler produces a cement having a rapid rate of setting and hardening. B.C.R.

SEPARATE PUBLICATION

Ceramic Technical Reviews. Published by Titanium Alloy Mfg. Co., Niagara Falls, N. Y. Price $2.50.—This is a compilation of 48 research reports and papers prepared by members of the Titanium Alloy Mfg. Co. staff and others. Most of these reports appeared originally in the *Journal of the American Ceramic Society*, but many have never heretofore been printed. This novel way of presenting the work has been greatly appreciated by many in the industry. Additional papers will be issued periodically.

PATENTS

Enameling. L. J. FROST (Titanium Alloy Mfg. Co.). U. S. 2,347,187, April 25, 1944 (Feb. 7, 1942).—A frit composition for forming vitreous enamels containing 32 to 58 silica, 6 to 16 zirconium oxide, 4 to 9 titanium oxide, 0.5 to 3.5 phosphorus pentoxide, less than 3.5 alumina, 6 to 14 boric anhydride, 13 to 20 soda, and 2.5 to 11% fluorine.

Glass-lined tank head. F. W. LAUCK (A. O. Smith Corp.). Can. 419,337, March 28, 1944 (March 8, 1943; in U. S. April 25, 1942). G.M.H.

Glass

Analysis of cords and stones. G. J. ZARBO, H. J. HUNT, AND D. C. SMITH. *Jour. Amer. Ceram. Soc.*, **27** [5] 138–42 (1944).—5 figures.

Anomalous flow in glasses. NELSON W. TAYLOR. *Jour. Phys. Chem.*, **47**, 235–53 (1943).—Viscosity and elasticity measurements give an insight into the structure of glasses. For every temperature there is an equilibrium viscosity characteristic of the stabilized glass, but a long time may be necessary before equilibrium is reached. When stabilized glass is subjected to a constant stress, the elongation is a summation of elastic adjustment and viscous flow. Elasticity data are given for soda-silica and potash-silica glasses. The superposition of independent relaxation processes of different characteristic rates gives rise to anomalous elastic reversals. A comparison is drawn between a typical dielectric absorption curve for glass and the drift in the ice point of glass thermometers when subjected to various temperatures. R.A.G.

Are glass manufacturers expecting a postwar glass age? ANON. *Ceram. Ind.*, **42** [4] 102–103 (1944).—It is believed that the postwar market for glass will be along conservative lines but that the use of glass will increase steadily. H.T.

* **Electrical conductivity of silver borate glasses.** B. I. MARKIN. *Zhur. Obshcheĭ Khim.*, **11**, 285–92 (1941); abstracted in *Physik. Ber.*, **23** [14] 1147 (1942).—Ag borate glasses are obtained at Ag_2O concentrations below 60%. Like all Ag glasses, they are covered after firing with a thin Ag layer. Their electrical conductivity (K) has the following relation to temperature: $\log K = A/T + B$, where T is absolute temperature and A and B are constants. Glasses with over 40% Ag form, when current passes through them, dendrites which effect the passage of electrons. The Ag ion is the most mobile in the glass. The values of log K, A, B, and D are given for some glasses. See *Ceram. Abs.*, **23** [5] 87 (1944). M.HA.

* **Foaming of glass.** V. ČTYROKÝ. *Sklářské Rozhledy*, **19**, 3–9 (1942); abstracted in *Physik. Ber.*, **23** [16] 1583 (1942).—In the production of container glasses, various types of feldspar, pegmatite, and granite (native to Czechoslovakia) were used. Some feldspars cause strong foaming if they have more than 1% loss by annealing; with losses less than 1% no trouble occurs. The cause of foaming is chemically bound water which escapes only at high temperatures. Foaming is reduced in glasses with 8 to 10% Al_2O_3 (but with less than 2% loss by annealing in the feldspar) by adding fluorspar. The production of foam glass and its properties are discussed. M.HA.

* **Glass fiber and its application in electrotechnics.** A. ESME. *Électricité*, **25**, 253–56 (1941); abstracted in *Physik. Ber.*, **23** [16] 1584 (1942).—While braided glass band gives 5 to 10 times more insulation than cotton or silk, their dielectric properties are the same. The mechanical properties are much superior, especially at elevated temperatures: tensile strength 175 kg. per mm.^{2} at room temperature, 180 at 150°, 170 at 250°, 135 at 350°, and 60 at 450°; softening point 676°C.; melting point 843°; expansion coefficient 49×10^{-7}. M.HA.

Glass patents seized from enemy and occupied countries can work for us. ANON. *Ceram. Ind.*, **41** [6] 57–58 (1943).—Patents available to American manufacturers and of interest to the glassmaker are listed. See "Foreign . . . ," *Ceram. Abs.*, **22** [10] 170 (1943). H.T.

Glass Science, Incorporated. FRANK L. JONES. *Bull. Amer. Ceram. Soc.*, **23** [5] 176–77 (1944).

Letters establish source of cords. ANON. *Ceram. Ind.*, **41** [5] 50–51; [6] 53–55 (1943).—Two ceramic engineers discuss the problem of cords by correspondence Illustrated. H.T.

* Obtained from microfilm.

Moist atmosphere improves durability of glass. A. E. BADGER. *Ceram. Ind.*, **42** [4] 98–100 (1944).—To increase the chemical durability of a glass surface, a fluorine-bearing glass was heated in a moist atmosphere to about 900°C. for 1 hr. The slow evolution of SiF_4 and its reaction with moisture produced a silica-rich glass surface of greater resistance to attack than that of the untreated glass. 2 figures. H.T.

* **New relation for the calculation of the density of glasses.** J. M. STEVELS. *Chem. Weekblad*, **39**, 15–20 (1942); abstracted in *Physik. Ber.*, **23** [12] 1274 (1942).—The new relation is $\gamma d = C - Rc$, where γ is gram atoms of O for 100 gm. glass, C is a general constant, c is a constant depending on the glass-forming oxide, and R is the ratio of the numbers of O atoms to the number of glass-forming oxides. If R is <3.9, the density cannot be calculated by this formula, which is explained by the glass structure as assumed by Zachariasen. M.HA.

New war standards on glass and porcelain radio insulators. H. R. WILSEY. *Ind. Standardization*, **15** [1] 6–7 (1944).—The American war standard on porcelain radio insulators (C75.14-1944) has just been approved, shortly after the standard on glass radio insulators (C75.8-1943). Standard insulators have been specified, together with dimensional tolerances and finishes; included in the appendix are recommended design criteria. See "Second . . . ," *Ceram. Abs.*, **23** [4] 74 (1944). W.D.F.

Ninety-three million gross of glass containers to be made in 1943. ANON. *Ceram. Ind.*, **41** [5] 52–55 (1943).—At the meeting of the Glass Container Assn., Oct., 1943, it was brought out that $2^1/_2$ times as many goods are packed in glass now as in 1940. A further increase in 1944 can be expected. H.T.

Rapid method for estimating soda in glasses: II. S. R. SCHOLES AND ERIC DE R. FALCÃO. *Jour. Amer. Ceram. Soc.*, **27** [5] 148 (1944).—1 reference. For Part **I** see *ibid.*, **16** [7] 342–43 (1933).

* **Stress relaxation in glass at constant temperature.** A. DAUVALTER. *Zhur. Tekh. Fiz.*, **10** [3] 243–49 (1940); abstracted in *Physik. Ber.*, **23** [12] 1275 (1942).—Supplementing a previous paper on the velocity of relaxation of stresses in glass (*Ceram. Abs.*, **18** [10] 267 (1939)), the theory is derived. The formulas show a good agreement with practical observations. M.HA.

Surface layer of sheet glass. F. L. BISHOP, JR. *Jour. Amer. Ceram. Soc.*, **27** [5] 145–48 (1944).—6 references, 4 figures.

Surface tension and persistence of cords in glass. MELLEN A. KNIGHT. *Jour. Amer. Ceram. Soc.*, **27** [5] 143–45 (1944).—1 reference.

Tank design and processing comes in for engineers' scrutiny. ANON. *Ceram. Ind.*, **41** [5] 56–57 (1943). H.T.

* **Technological problems in the development of a new series of transmitting tubes.** E. G. DORGELO. *Philips' Tech. Rundschau*, **6** [9] 257–63 (1941); abstracted in *Physik. Ber.*, **23** [15] 1491 (1942).—A new series of transmitting triodes and pentodes for the 5- to 7-m. band is described. Grid and anode are of Mo because of its high heat resistance; the cathode material is thoriated tungsten, which has a specific emission of 70 ma. per watt against 6 ma. for pure tungsten. The bulb is made of a newly developed (not described) type of glass. The fusing of the terminal wires and the oxide-free lead-in wires of W and Mo are mentioned particularly, as they remain perfectly tight even at 400°C. and higher. A Zr getter binds gas residues at low temperatures. M.HA.

* **Technological problems in the shaping of radio tubes.** T. P. TROMP. *Philips' Tech. Rundschau*, **6** [11] 321–28 (1941); abstracted in *Physik. Ber.*, **23** [15] 1490–91 (1942).—Technical details of melting terminal wires into the walls and the covering of the tubes are discussed. Advantages and disadvantages of both glass and metal covers are compared. For the field of short waves of meter and decimeter length, only glass tubes can be used. M.HA.

Viscosity of recent container glass. HOWARD A. ROBINSON AND CHARLES A. PETERSON. *Jour. Amer. Ceram. Soc.*, **27** [5] 129–38 (1944).—14 references, 6 figures.

What is the best way to cool a glass tank? ANON. *Ceram. Ind.*, **42** [2] 51 (1944).—A suggestion for increasing the life of glass tanks is given. H.T.

PATENTS

Apparatus for manufacturing bent tempered sheets of glass. GERALD WHITE (Libbey-Owens-Ford Glass Co.). U. S. 2,347,382, April 25, 1944 (April 10, 1939).

Apparatus for producing fibrous glass. GAMES SLAYTER (Owens-Corning Fiberglas Corp.). U. S. 2,348,182, May 2, 1944 (Aug. 4, 1938; Aug. 16, 1940).

Bottle-blowing machine. H. P. COX, JR. (Armstrong Cork Co.). U. S. 2,347,181, April 25, 1944 (Jan. 25, 1943).

Building block and method of making. L. O. GRIFFITH (Pittsburgh-Corning Corp.). U. S. 2,347,556, April 25, 1944 (June 29, 1939).

Coated glass-fabric window shade. C. S. HYATT AND T. J. KERR (Columbus Coated Fabrics Corp.). Can. 419,018, March 14, 1944 (Dec. 24, 1940; in U. S. Dec. 2, 1940). G.M.H.

Concrete slab or block. A. W. SODEN AND J. A. LINCOLN. Can. 419,100, March 21, 1944 (Feb. 11, 1942).—A slab is formed of concrete or other plastic material having a reinforcement of glass. G.M.H.

Copperplating of mirrors. WILLIAM OWEN (Pittsburgh Plate Glass Co.). U. S. 2,347,608, April 25, 1944 (March 8, 1941).

Glass composition and product. E. D. TILLYER, H. R. MOULTON, AND T. M. GUNN (American Optical Co.). Can. 418,500, Feb. 22, 1944 (July 31, 1940). G.M.H.

Glass envelope sealing apparatus. F. C. PERKINS (Canadian General Electric Co., Ltd.). Can. 419,012, March 14, 1944 (March 9, 1943). G.M.H.

Making glass electrodes. H. H. CARY AND W. P. BAXTER (National Technical Laboratories). U. S. 2,346,470, April 11, 1944 (Aug. 2, 1940).

Making hollow glass bodies. KARL RUDOLPH (vested in the Alien Property Custodian). U. S. 2,347,614, April 25, 1944 (March 14, 1941).

Metal-to-glass or like material seals. STANDARD TELEPHONES & CABLES, LTD. Brit. 559,806, March 15, 1944 (Jan. 31, 1942).

Mirror manufacture. ANDREW LEVAGGI. Can. 419,259, March 28, 1944 (July 20, 1943). G.M.H.

Ophthalmic lens. E. D. TILLYER (American Optical Co.). Can. 418,501, Feb. 22, 1944 (June 16, 1942). G.M.H.

Radio tube sealing-off machine. N. R. SMITH (Radio Corp. of America). Can. 418,441, Feb. 15, 1944 (Jan. 13, 1942). G.M.H.

Telephoto lens. FRITZ KASTILAN (Bernard Chadkin). U. S. 2,346,312, April 11, 1944 (Oct. 29, 1941).

Tempering glass articles. J. T. LITTLETON AND R. K. DAY (Corning Glass Works). U. S. 2,347,116, April 18, 1944 (June 24, 1937).—In a method of tempering a hollow glass article having side walls and a bottom which includes heating the article to a temperature near the softening temperature of the glass from which it is made and rapidly chilling the article to set a permanent condition of strain therein, the steps of chilling the exterior of the article by fluid contact and introducing the chilling fluid into the interior of the article before chilling fluid is applied to the exterior of the article.

Treatment of glassware. VICTOR WALKER (AlnCin, Inc.). U. S. 2,347,011, April 18, 1944 (Sept. 4, 1942).—The method of recessing glass stock comprising applying thereto a recessing solution comprising an aqueous solution of a mixture of sulfuric acid and hydrofluoric acid wherein the ratio of sulfuric acid to hydrofluoric acid is sufficient to cause effervescence as a result of the action between the sulfuric acid ingredient and the fluoride products of the action of the hydrofluoric acid ingredient on the glass stock and sufficient to insure continuous mechanical removal of the salt by-products of the chemical reactions upon the glass stock so as to avoid masking of the latter by salt deposits from uninterrupted action of the hydrofluoric acid.

* Obtained from microfilm.

Structural Clay Products

***Conveying equipment in the brick industry.** KROSCHWALD. *Tonind.-Ztg.*, **67** [3/4] 29–32 (1943). M.Ho.

***Development and present significance of wet edge mill in the brick industry.** W. HERBRING. *Tonind.-Ztg.*, **67** [9/10] 74–77 (1943). M.Ho.

***Dutch brick industry.** W. NEIMANN. *Tonind.-Ztg.*, **67** [5/6] 38–42 (1943).—N. reviews the brick industry in Holland. M.Ho.

Economical method of scum prevention. R. K. ROBERTSON. *Clay Products News*, **17** [4] 11–12 (1944).—R. describes a method of using barium sulfide for scum prevention. A hot solution is made of the sulfide, which is then mixed with about 9 times its volume of cold water and agitated continuously. This mixture is used for pugging water. The sulfide is 3 times as effective as the carbonate, pound for pound. G.A.K.

Practical builder is keyman to postwar sales. J. M. LANGE. *Ceram. Ind.*, **42** [4] 56 (1944). H.T.

Salt-glazed drainpipe, chimney pots, and fire-clay oddstuffs. ANON. *Claycraft*, **17** [6] 297–300 (1944).—In making sewer pipe 15 in. and 18 in. in diameter it is often difficult to make them the exact length required and to keep them perfectly cylindrical. A method is described in which the pipe is placed on a board on a revolving turntable. A hardened steel serrator, which can be set for any desired depth, is swung to the pipe, and serrations are cut. A cutting arm then cuts a ring from the end of the pipe. After drying for 24 hr. the pipe is placed in a tipper, and a drum the length of the pipe required is placed inside it. The clay ring is knocked off, and the end of the pipe is trimmed with a special cutter. Illustrated. G.A.K.

SEPARATE PUBLICATIONS

Load-Bearing Concrete Brickwork and Masonry (Not Reinforced). British Standard Specification No. 1145—1943. British Standards Inst., London. Published Nov. 15, 1943. Price 2s.—Concrete: The cement shall conform to one of the three following specifications: B.S.S. No. 12, 146, or 195. The aggregate shall be (1) Natural aggregate complying with B.S.S. No. 882, (2) blast-furnace slag complying with B.S.S. No. 1047, or (3) crushed fired clay made by crushing fully fired brick, tile, or other ceramic products and conforming to clauses 2, 3, 4, and 5 of B.S.S. No. 882 (except par. 1). The sulfur content (as SO_3) shall not exceed 0.50%. The increase in weight when soaked in water shall not exceed 10%, except for interior work when it is not to exceed 16%. Proportions of ingredients to be used and minimum cube strengths specified are given in a table. The maximum pressure to which the concrete may be subjected depends on its slenderness ratio and is shown in the table. Brickwork and Masonry: They shall be laid in one of seven specified types of mortar. All structural units have a crushing strength not less than 1500 lb. per sq. in. Brick must be new and must conform to B.S.S. No. 657, 187, or 834. Brick with cavities or perforations shall contain not less than half their total volume, and no web shall be less than $^5/_8$ in. thick. Natural stone must be free from detectable defects. The mortar may consist of cement or lime (or both) until fine aggregate complying with B.S.S. No. 882 or of burned clay. The grading, the proportions of ingredients, and the maximum permissible pressures are shown in a table. Directions for testing are included. A.B.S.

Peat Moss or Sphagnum Moss. HARALD A. LEVERIN. *Can. Dept. Mines, Bur. Mines, Mines & Geol. Branch, Dept. Mines & Resources, Pub.*, No. 809, 10 pp. (1943). Price, paper, 10¢.—When used in making building brick, peat moss yields a product of high porosity, light weight, and good heat- and sound-insulating value. G.M.H.

Reinforced Brickwork. British Standard Specification No. 1146—1943. British Standards Inst., London. Published Nov. 15, 1943. Price 2s.—Brick shall conform to B.S.S. No. 657 or B.S.S. No. 187, with a water absorption not greater than 20%. Cement shall conform to B.S.S. No. 12 or B.S.S. No. 146. Lime must conform to B.S.S. No. 890. Fine aggregate shall conform to B.S.S. No. 882 (modified) or crushed fired clay with specified properties. Mortar must consist of cement 1, fine aggregate not more than $3^1/_2$, and slaked lime $^1/_8$ to $^1/_4$ part by volume. Reinforcement shall conform to B.S.S. No. 785 or B.S.S. No. 405. The maximum permissible stresses are specified in three tables. Spacing, anchorage, cranking, and splicing must also conform to the Specification. The brick must be soaked before use, but complete saturation is undesirable. Methods of testing are also specified. A.B.S.

PATENTS

Adjustable die for forming curved brick. E. A. RENDER. U. S. 2,346,393, April 11, 1944 (Dec. 6, 1941).

Ceramic body production. W. L. C. VAN ZWET. Can. 418,358, Feb. 8, 1944 (Dec. 11, 1941).—A method of manufacturing ceramic bodies comprises preparing a mixture of ceramic material and a cellulose ether capable of swelling or dissolving in water, molding the mixture, and sintering. G.M.H.

Waterproofing agent for brick or stones. J. C. B. MCGUFFIE. Can. 418,381, Feb. 15, 1944 (Nov. 7, 1938).—A waterproofing agent consists of an aqueous emulsion of a saponifiable wax, made solely by the addition of an alkaline carbonate and a gelatinous body to a suspension of the wax in water. G.M.H.

* Obtained from microfilm.

Refractories

Availability of Indian kyanite for superrefractory manufacture. C. W. FYFE. *Ind. Heating*, **11** [4] 610–12 (1944).—F. points out the plentiful supply of Indian kyanite for the manufacture of mullite refractories, whose outstanding refractory properties are as follows: (1) Their softening point is several hundred degrees higher than that of any ferrous or nonferrous alloy and closely approaches the fusing temperature of 3335°F. (2) The coefficient of expansion is low, 0.0000048. At 3200°F. mullite shows 0.0% permanent linear shrinkage. It is fired at a temperature well above any to which it will be subjected in use. (3) Resistance to deformation and load-bearing strength at high temperature are very great; under the standard A.S.T.M. test at 2650°F. with 50 lb. per sq. in. load mullite shows no deformation and at 3000°F., less than 2% deformation. (4) The high softening and fusing point gives mullite extreme resistance to vitrification, which is the primary cause of spalling. (5) Kyanite imparts to mullite high resistance to slag erosion. With high refractoriness and only 16% porosity, resistance to penetration is high. (6) The heat conductivity is low, and chemical neutrality minimizes the affinity of alloys for this refractory; it is not affected by either reducing or oxidizing atmospheres. When used in cupola furnaces, mullite slag-hole blocks last the entire heat; in ladles, mullite linings have 3 to 5 times the useful life of formerly used materials. Side walls of malleable furnaces require relining only after 75 to 100 heats as compared with 20 to 24 heats formerly. Electric steel furnaces with mullite roofs average 175 instead of 42 heats, and forging furnaces, formerly rebuilt every two months, are now rebuilt only once a year. M.Ha.

***Hydration of magnesite brick.** W. STEGER. *Zement*, **32** [15/16] 158–64 (1943).—Producers and users of magnesite brick are familiar with the fact that under certain conditions magnesite brick loses its strength, increases in volume, forms cracks which may fracture the brick, and in severe cases disintegrates to a powder. This phenome-

non was attributed to the hydration of MgO present in the brick and within the last decade was proved conclusively. The purpose of this investigation was to determine the temperature, humidity, pressure, and time most propitious for the hydration of commercial magnesite brick. Six kinds of magnesite brick and one kind of forsterite brick were investigated. From the time of their production to the start of the experiments the specimens were kept in desiccators. The following tests were made: (1) Specimens were exposed for 31 days at room temperature in a desiccator filled with (*a*) 10% H_2SO_4, 97% relative humidity, (*b*) 30% H_2SO_4, 75% relative humidity, and (*c*) 40% H_2SO_4, 55% relative humidity. (2) Specimens were exposed to a vacuum and then kept in water (*a*) at room temperature for 30 days and 90 days, (*b*) at 60° for 3 days, and (*c*) at 90° for 1, 2, and 3 days. (3) Specimens were heated in superheated steam in an autoclave at 1, 2, 3, 4, and 6 atm. for 1 hr. each. (4) Specimens were exposed to superheated steam at atmospheric pressure at (*a*) 150° for 1 and 24 hr., (*b*) 200° for 1 hr., and (*c*) 300° for 1 hr. After each test the amount of hydration was determined as follows. The test piece was dried for 2 hr. at 120° and weighed. It was next heated for 1 hr. at 750° and again weighed. The difference in weight is H_2O. Multiplying by 3.24 gives the weight of hydrated MgO. At room temperature hydration was insignificant. Prolonged exposure to water or very humid air causes measurable hydration. In air saturated with water vapor hydration increases with rising temperature. At atmospheric pressure 60° to 90° is the most favorable temperature for hydration. At temperatures over 100° superheated steam has but little effect on magnesite brick. At 200° to 300° hydration ceases; above 300° there is no hydration. Forsterite specimens were very resistant to hydration. Even at the severest conditions, 1 hr. in steam at 6 atm., it hydrated less than 1%, whereas magnesite under the same conditions hydrated approximately 10%. M.Ho.

***Measuring the shell temperatures of rotary cement kilns.** Erich Findel. *Zement*, **32** [13/14] 140–43 (1943).—A new thermoelectric pyrometer is described. Procedures for its calibration are given. M.Ho.

Pressing firebrick in a Spengler press. T. P. Derid. *Ogneupory*, **1941**, No. 2, p. 108; *Trans. Brit. Ceram. Soc.*, **42** [7] 56A (1943).—Properties of firebrick pressed in a Spengler-type press (revolving 8-mold table, top and bottom pressing in three stages) are compared with those of brick produced in a Boyd-type press. The Spengler press produced more uniform, denser, and stronger brick.

Refractories keep pace with industrial progress. Chester R. Austin. *Brick & Clay Record*, **104** [1] 39–42, 44 (1944).—A. presents a review of developments in the refractories field. B.C.R.

Selection of blast-furnace refractories. Hobart M. Kraner and E. B. Snyder. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1727; *Metals Tech.*, **11** [3] 12 pp. (1944).—Volume stability, low porosity, and decreased pyroplasticity are desirable for blast-furnace linings, particularly for the hearth. A hot load test is a valuable means of testing the fusion or softening behavior of a refractory at operating temperatures. Tests with carbon monoxide on commercial blast-furnace refractories in their "as received" condition and after refiring show that many refractories disintegrate badly but that refiring decreases the effect. Certain special refractories are now available which are almost free of the tendency. W.D.F.

***Technology of chrome-magnesia brick.** Friedrich Lipinski. *Tonind.-Ztg.*, **67** [15/16] 139–49 (1943).—The purpose of this investigation was to study the reactions between the spinels found in Cr ores and magnesia or magnesite with due regard for the magnesia, alumina, and Mg silicates always present in Cr ores. The experiments were divided into several series: (1) Only oxides were used, and the following reactions were tested: MgO + Al_2O_3, FeO + Al_2O_3, MgO + Cr_2O_3, and FeO + Cr_2O_3. These products were tested with MgO. In series 4 to 8 (2) MgO and FeO were used together and both tested with Al_2O_3 and Cr_2O_3. (3) Experiments were carried out with FeO + Al_2O_3 and FeO + Cr_2O_3 products from series 1. experiments were conducted with various ores. The reactions were tested at 1300° and 1500°. Of the four oxides, MgO was the most reactive. The sesquioxides differed more in their reactivity at the lower temperature than at the higher. With increasing temperature the reactivity of Al_2O_3 rises more rapidly than the reactivity of Cr_2O_3. In the 3-component experiments, MgO·FeO··R_2O_3, the simultaneous formation of both spinels progressed unimpeded. Only when the R_2O_3 became nearly saturated was the formation of the FeO spinel retarded. At a MgO:FeO:Cr_2O_3 ratio of 2:1:1 and a temperature of 1500°, a Mg spinel is formed quantitatively, the Fe spinel being completely suppressed. When Al_2O_3 is used instead of Cr_2O_3 similar results are obtained with a molecular composition of 4:1:1. The reaction between FeO··Al_2O_3 or FeO·Cr_2O_3 and MgO is analogous to the preceding; thus, by choosing the proper temperature, time, and MgO content, FeO spinels can be converted quantitatively into MgO spinels. Of greater practical significance are the reactions taking place when ores are used. A quantitative reaction between the ferrochromite of a Cr ore and MgO is feasible if the proper reaction conditions are maintained. Aluminates and silicates impede the reaction, the silicates interfering more than the aluminates. The reaction between ferrochromite and MgO proceeds differently in a reducing atmosphere than it does in an oxidizing atmosphere. In a weakly reducing atmosphere the chromite crystals remain unchanged. The Mg ions penetrate the lattices and displace the Fe ions. In a weakly oxidizing atmosphere, two reactions take place simultaneously (exchange reaction and oxidation of FeO), thus disrupting the chromite crystal. In either case, after the exchange reaction is ended, complete recrystallization takes place. In this process aluminates and ferrites participate, forming mixed crystals. Cr ores transformed into MgO chromite and the brick made thereof are more resistant to oxidation and to the corrosive action of slags than is FeO chromite. M.Ho.

* Obtained from microfilm.

PATENTS

Bauxite process and product. J. A. Heany (Heany Industrial Ceramic Corp.). U. S. 2,347,685, May 2, 1944 (March 16, 1937).—A process of producing bauxite ceramics which comprises heating the bauxite material to a temperature above 500°C. and below about 1000°C. until it is dehydrated, wet grinding to a fineness of less than 50 microns and ranging primarily between 5 and 20 microns, forming, and firing.

Magnesia hydroxide production. F. N. Pickett (Ocean Salts (Products), Ltd.). Can. 419,062, March 14, 1944 (Aug. 13, 1941). G.M.H.

Making magnesian refractories. D. W. Ross. U. S. 2,347,968, May 2, 1944 (April 16, 1943).—The method of making a magnesian refractory which comprises mixing with a composition that is mainly of magnesia, magnesium ammonium fluoride in quantity only sufficient to form a bond and perform a bonding function, forming a body from the mixture, and firing it to a point at which it becomes bonded.

Manufacture of aluminum hydroxide. F. H. Rogers (G. Antonoff). Brit. 548,863, Nov. 11, 1942 (Jan. 20, 1942).

Producing alumina. E. E. Fisher (Marlew W. Fisher). U. S. 2,347,736, May 2, 1944 (July 24, 1943).—In a process for treating an aluminous siliceous material from an aluminous siliceous material which comprises mixing with the material a calcium compound and a sodium compound, subjecting the mixture to a temperature above 1500°F. but not greater than 2000°F. for a period greater than 4 hr., adding to the product a sodium compound, resubjecting the resultant mixture to approximately the same temperature for approximately 1 hr., and then mixing the resulting product with water to remove the sodium aluminate formed during the two heating steps.

Zirconium oxide refractory and method of making. EUGENE WAINER (Titanium Alloy Mfg. Co.). U. S. 2,347,225, April 25, 1944 (Jan. 19, 1942).—A composition suitable for forming refractory structures comprising a major quantity of zirconium oxide, 0.002 to 0.5% of a water-dispersible colloid, and 0.002 to 0.5% of a monohydroxyl base, such percentages being based on the weight of the zirconium oxide.

Terra Cotta

SEPARATE PUBLICATION

Glazed Tile Fireplaces. British Standard Specification No. 1108—1943. British Standards Inst., London. Published March 14, 1943. Price 1s.—Glazed tile fireplaces are to be rectangular in shape with straight sides and top and no steps, projections, panels, or other deviation from a flat surface. The fire opening is to be rectangular and not more than 16 in. wide. Only 6 x 6 in. flat tile, 6 x 6 in. round-edge tile, and blocks 4 in. wide (at fire opening) are to be used. Tile of only one color is specified. A.B.S.

Whiteware

American manufacture of textile porcelains greatly aids war effort. ANON. *Ceram. Ind.*, **41** [6] 61–65 (1943).—A description of the Page-Madden Co. plant in Mineola, N. Y., is given. 15 illustrations. H.T.

Binders—what they do in steatite production. W. H. GORT. *Ceram. Ind.*, **42** [3] 60–62 (1944).—A brief review of temporary organic binders is given. H.T

Dielectric or puncture strength of porcelain and other ceramic materials. E. ROSENTHAL. *Electronic Eng.*, March, 1943; *Trans. Brit. Ceram. Soc.*, **42** [7] 61A (1943). —The test methods for ascertaining the dielectric strength of electrical insulating materials at power frequencies used by America and Germany are discussed. Dielectric failure of solid insulating materials occurring in disruptive breakdown and in thermal breakdown and the relation of the breakdown strength to thickness of material are described and illustrated. Unequal field distribution, concentration of the field, and edge effects have a great influence on breakdown voltage. In the design of electrical insulators, field concentrations can be avoided and field distribution improved by suitable design of both the electrodes and the insulator; this is achieved by suitable assembly methods and by the application of conductive and semiconductive coatings on the surface of the insulator. The importance of the hard and nonattackable surface of porcelain and porcelain glazes is referred to. The duration and rate of increase of applied voltage and the effect of voltage characteristics on breakdown strength of ceramics are discussed, and the influence of the temperature of the material on the dielectric strength is illustrated graphically.

Potters talk about postwar mechanization, merchandizing, labor. ANON. *Ceram. Ind.*, **41** [6] 68–73 (1943). H.T.

Production methods are compared for five chinas of the world. ANON. *Ceram. Ind.*, **41** [5] 68–74 (1943).—Comparisons are made between Belleek, American, bone, European, and Oriental china. Illustrated. H.T.

Steatite shrinkage controlled by raw materials and processing. H. THURNAUER. *Ceram. Ind.*, **42** [4] 110–14 (1944).—Various factors affecting the shrinkage of steatite bodies are described. A method of controlling these factors in plant practice is given. H.T.

PATENTS

Ceramic article. T. G. MCDOUGAL, KARL SCHWARTZWALDER, AND A. H. FESSLER (General Motors Corp.). Can. 419,315, March 28, 1944 (June 29, 1940). G.M.H.

Ceramic-article manufacture. T. G. MCDOUGAL AND KARL SCHWARTZWALDER (General Motors Corp.). Can. 419,316, March 28, 1944 (July 3, 1940). G.M.H.

Ceramic insulator. L. R. SHARDLOW (Radio Corp. of America). Can. 418,592, Feb. 22, 1944 (Dec. 17, 1940). E. J. W. VERWEY AND M. G. VAN BRUGGEN. Can. 418,626, Feb. 22, 1944 (Dec. 11, 1941). G.M.H.

Ceramic-insulator manufacture. PIETER GOEDE, L. T. SCHEERMAN, M. G. VAN BRUGGEN, E. J. W. VERWEY, AND R. D. BÜGEL (Philips Lamps, Ltd.). Can. 418,319, Feb. 8, 1944 (March 21, 1938; in Holland April 6, 1937). G.M.H.

Ceramic mold. J. R. THOMPSON (Hall China Co.). U. S. 2,346,626, April 11, 1944 (Oct. 2, 1940; Dec. 26, 1940).

Ceramic process. F. C. HENDERSON (Hall China Co.). U. S. 2,346,579, April 11, 1944 (April 10, 1942).

Chinaware sanding machine. W. H. EMERSON (Homer Laughlin China Co.). U. S. 2,347,940, May 2, 1944 (Jan. 11, 1943).

Forming insulator bodies. E. M. SKIPPER (Locke Insulator Corp.). U. S. 2,346,620, April 11, 1944 (Nov. 28, 1940).—The method of producing high tension insulator bodies which includes simultaneously mixing unfired porcelain clay ingredients including scrap clay with sufficient water to give to the mixture a water content of between 11 and 13%, introducing the mixed mass into a high pressure pug mill, extruding the product, and finally shaping selected portions thereof to produce therefrom high tension insulator bodies.

Insulator. C. J. LEMONT (Line Material Co.). U. S. 22,469, April 11, 1944 (June 18, 1943); reissue of original U. S. 2,259,526, Oct. 21, 1941 (April 12, 1940).

Manufacture of glazed ceramic bodies. G. J. BAIR (Norbert S. Garbisch). U. S. 2,347,535, April 25, 1944 (Nov. 29, 1938; June 15, 1940).—A process of forming a mixture of finely divided silica and glass resulting from the grinding and polishing of glass with waste sand into glazed ceramic bodies, the process comprising heating the material to the sintering point of the glass therein in small portions corresponding to the finished bodies, pressing the portions successively in order to compact them and shape them into the desired form and to effect coherence into hard, strong, dense masses, passing each body as it is received from the pressing operation through a heating kiln, and sprinkling pulverized glazing material upon the bodies as they are received from the kiln and while sufficiently hot to fuse down the glazing material.

Manufacture of spark plugs. AC.-SPHINX SPARKING PLUG CO., LTD., AND D. H. CORBIN. Brit. 559,805, March 15, 1944 (Jan. 28, 1943).

Spark plug. C. M. CARINGTON, G. W. SHOOBERT, AND K. L. G. SPARKING PLUGS, LTD. Brit. 559,709, March 15, 1944 (Aug. 24, 1942). S. D. HERON (one-half to Ethyl Corp. and one-half to United Aircraft Corp.). U. S. 2,347,050, April 18, 1944 (Aug. 12, 1942). S. D. HERON AND KARL BEAVER (one-half to Ethyl Corp. and one-half to United Aircraft Corp.). U. S. 2,347,051, April 18, 1944 (Aug. 12, 1942).

Spark plug. C. M. CARINGTON AND G. W. SHOOBERT (K.L.G. Sparking Plugs, Ltd.). Can. 418,307, Feb. 8, 1944 (Nov. 19, 1942). TULLIO TOGNOLA (Bendix Aviation Corp.). Can. 418,392, Feb. 15, 1944 (Oct. 21, 1941; in U. S. Jan. 31, 1941). Can. 419,285, March 28, 1944 (April 15, 1941; in U. S. July 9, 1940). G.M.H.

Equipment and Apparatus

Ball wear in cylindrical mills. T. K. PRENTICE. *Jour. Chem. Met. Mining Soc. S. Africa*, **43** [7–8] 99–132 (1943); abstracted in *Can. Mining Jour.*, **64** [7] 451 (1943).
G.M.H.

Driers: heat and mechanical. F. R. FARMER. *Chem. Age* [London], **50** [1279] 5–8 (1944).—Using the term "liquid" to include clay slips and slurries, F. states that the removal of water from a liquid should be in two stages, (1) evaporation, filtration, or centrifuging and (2) drying. It is often easier and cheaper to dry from a smooth free-flowing cream than from a filter-press cake. When a cream containing 50% solids is dried on a rotary film or drum drier, one ton of powder per hour requires the evaporation of 1.25 tons of water and gives a free-flowing powder not requiring grinding, but if further settled or pressed down to 33% water, a pasty solid or cake is obtained which can be dried (*a*) in a rotary drier using air, (*b*) on hearths with rabble arms or stationary, (*c*) in tunnels, or (*d*) in cupboards. There are only 10 cwt. of water per hour left to evaporate, but of the total heat 33 to 40% is lost in outgoing air and 10 to 15% is lost by radiation, etc. The steam required is still 1.25 tons, and the product is in lumps requiring further handling and grinding. If the material originally contained 70% water, it would mean the evaporation of 2.25 tons of water as against 10 cwt., so that dewatering would be advisable. It may pay to rewet it back to 50% solids, i.e., the optimum concentration at which it will dry from a liquid to a finely divided powder. Press cakes dry slowly, the drying time being 2 hr. to 2 days. The product is lumpy and requires grinding. Slow drying is inefficient, as a large plant is required to accommodate all the material being dried, e.g., tunnels 100 to 200 ft. long. This represents a high loss of heat by radiation, etc., and in batch plants there are losses by leakages of air, loading and unloading operations, and periodic cooling and heating of the plant. The best operating temperature must be used. The inlet air temperature should not be raised too high; 200° to 250°C. is the usual maximum, as higher temperatures cause high loss by radiation unless lagging is efficient. The outlet air temperatures should be considerably above the saturation point. Few changes can be made in a tunnel drier, as the variables of size, length, etc., output, air temperatures, and velocity are closely related. The same principles are used in a cupboard drier except that this is a batch plant and employs air recirculation. A close check should be kept on the air adjustment, i.e., more fresh air at the beginning and very little at the end, to correspond with the drying rate. A common fault in many plants is the volume and distribution of the air circulation. If 80 to 90% of a material dries in 12 hr. but 18 hr. are required for the material to dry completely, the plant is left running until the whole batch is dry to avoid mixing batches and to cut down labor cost. In one plant with an hourly consumption of 12 kw., the wastage is 72 kw. for the excess time of 6 hr. It is often difficult or impossible to design the plant so that each tray receives the right amount of air. Baffles are used but are not sufficient; tray loading also causes local variations. The remedy is to increase the air circulation, giving most trays an unnecessarily large volume of air but ensuring sufficient circulation for all. In a plant with 12-kw. electric heaters, the air volume was increased from 6000 to 12,000 cu. ft. per min., requiring one extra b.h.p. on the motor. For 12 hours' operation, this is 12 kw. as against the saving of 72 units due to the 6 hours' reduction in drying time. The net saving is 60 units or 30 tons of coal per year. The gain may be 10 times as great in a large plant. The solution of the difficulties in drying cakes lies in approximating the conditions for liquid drying, i.e., drying quickly and finishing with a free-running powder. In the TV drier, which dries cakes, crystals, and powder, the cake is dried when air borne in a vertical column, disintegrates, and exposes a large drying surface; it dries in a few seconds, producing a free-flowing powder. Methods of heating are usually electricity, gas, steam, or direct firing. Comparative costs for a typical plant are given. Direct firing is the cheapest but is usually ruled out, owing to contamination with dust. Filters are now available for use in hot gases at 0.10 to 0.25 in. water gauge which reduce contamination to one part per thousand or better. Electricity may be used to give higher temperatures than can be given by steam, e.g., 200° to 250°C. It is often possible to combine two methods of heating, e.g., steam for temperatures to 160°C. followed by electricity. In one instance there was a saving by this method of 40 to 50 tons of coal per year for a 120-hr. week. Usually, the outlet temperature of a drier should be well below 70° or 80°C. Direct firing with coke is much cheaper than steam heating, in the proportion of about 2 to 1, including handling. The possibility of using mechanical stokers with coke should not be overlooked. Waste heat in the form of flue gas is probably the cheapest medium for drying, but the fly ash is objectionable. The principal sources of inefficiency and of loss of heat found in drying plants are as follows: (1) Surface not lagged; the loss by radiation, etc., from the surface may be 50% of the total heat consumption. (2) Leakages of air, inward or outward; even a small 0.125-in. gap may result in the loss of 15 or 25% of the heat. (3) Temperatures too high; the outlet temperature from the drier is kept low (40° or 45°C.); there may be an increase in drying time of 50 to 100%, whereas an increase of 20°C. may so shorten the drying that the total of net heat units used is smaller. Every attempt should be made to secure equal distribution of air in the drier, but inequalities of load and other imperfections make it difficult; hence a margin of 100 to 200% in the quantity of air used is generally allowed. The power required for moving the air is relatively small, but the heat required for keeping the drier in operation for long periods may be large. Many driers used for drying pastes are inefficient, but two types may be considered, air-heated driers and direct steam-heated driers. An air drier uses 60 to 70% of its available heat. With filter cake, the dry material frequently requires further processing, and the cost of this must be added to the cost of drying. It is then cheaper to dry a cream on a suitable drier by steam heating than by air.

Balanced draft is a satisfactory method of reducing air leakage. The position of the fan in relation to the drier is important. Attention should be paid to airtightness of doors. The proportion of fresh air and circulated air should be regulated according to plan and not left to the operator. The rates might be controlled by a differential pressure gauge. Another control would be a hygrometer on the air outlet so that the operator would bleed off air in accordance with the humidity. The most economical speed at which to circulate the drying medium is 5.5 to 7 ft. per sec. over the trays at the temperature ruling; to avoid dead spaces, 100% should be added to the amount of air circulated in this way. The amount of air allowed to escape from the system should be sufficient to prevent the humidity from becoming unduly high. The amount of bleeding off determines the capacity of the drier, but the rate of drying is determined by the amount of air circulated. When material is exposed on a tray, the rate at which water will evaporate depends upon the air velocity, unless the end point is being approached, when internal diffusion becomes important. For determining humidity, only the wet-and-dry bulb hygrometer is recommended as a standard method. It gives reasonably accurate results if a good air flow is maintained over a wet bulb and the wet bulb is kept clean. A.B.S.

Drying troubles—how to avoid them. ANON. *Brick & Clay Record*, **104** [2] 16–18, 20 (1944).—Theoretical aspects of drying are reviewed briefly. Factors determining the rate at which water in the interior of the mass moves to the surface and evaporates are (1) size of capillaries, (2) length of capillaries, (3) amount of water in the clay, (4) rate of evaporation of water at the surface, and (5) character of clay—adsorption. Water must not be evaporated faster than it comes to the surface by capillary action. A rapid rate of removal of water may cause greater shrinkage

than slower rates. Means of reducing cracking due to causes other than drying are discussed. Preheating at 200° to 300°C. of plastic clays that cannot be dried without cracking helps to correct drying difficulties. B.C.R.

Electron microscope. W. WILSON. *Elec. Rev.*, **134** [3456] 218–22; [3457] 254–57 (1944).—W. discusses the instrument, its lenses, voltage effects, magnifications, specimen mounting, typical results, problems encountered, and limitations. 4 diagrams, 5 photographs. M.R.

Fuel efficiency in grinding plant. J. C. FARRANT. *Chem. Age* [London], **50** [1282] 101–104 (1944).—F. discusses the questionable economy of saving fuel by grinding fewer hours or by increasing the production per unit of power. The rate of feed should be proportional to the work to be done. Accurate control of feed to mills is essential; automatic control is being more widely adopted. Overloads on the motor and on the mill are undesirable, and in the mill the product must suffer either in reduced capacity or in grading so that the motor is automatically tripped out when any serious overload occurs; on the other hand, there are certain cases where the load is even in which motors have been run for long periods at 5% over their rated capacity. Roller mills absorb the least power per ton, ball mills absorb less power per ton on fine grinding than hammer mills, and hammer mills absorb less power per ton for coarse grinding than ball mills. The selection of the type of mill, however, depends largely on the physical characteristics of the material to be ground regardless of the power absorbed; other factors are maintenance, availability, floor space occupied, and capital cost. In ball mills, the noise emitted varies with the speed of the mill and may be used as an indication of the latter. The optimum speed is usually 65 to 85% critical but depends on several factors. The correct sizing of the material fed to the ball mill is also important. The correct quantity of balls of suitable sizes may be controlled by emptying out all the balls occasionally and regrading them. In all closed-circuit grinding, too large a proportion of fines will cause a waste of fuel. It is then necessary to modify the setting or to redesign the classifier or some of its components. Clear and practicable specifications are important, as some specifications cause needless waste in fuel. From a grinding standpoint, there should always be an upper limit, e.g., not more than 5% larger than 10μ. Such an example can be correlated to a surface factor with a reasonable tolerance, so that rapid checks can be taken during milling operations. Specifications requiring excessive fineness should be avoided; the difference between 99% through the 100 and 99% through the 200 is not vital for some processes, but the latter may require double power. A.B.S.

Microradiography—a new metallurgical tool. S. E. MADDIGAN AND B. R. ZIMMERMAN. *Amer. Inst. Mining & Met. Engrs. Tech. Pub.*, No. 1683; *Metals Tech.*, **11** [2] 26 pp. (1944).—Microradiography depends on the laws of absorption of X rays and the difference in absorption of two different phases. The variation of this difference of absorption with the wave length of the X rays used does not plot as a smooth curve but shows maxima and minima because of the presence of various absorption levels of the individual elements. It is necessary to pick an X-ray tube with the correct target and correct voltage to get the maximum contrast. Specimens were polished on one side; the other side was cut away in a lathe until it was 0.010 in. thick and then further polished to 0.005 in. The specimen was mounted back of a plate with a 1/8-in. hole, placed in contact with a high resolution photographic plate, and radiographed. After development, the negative was examined under a microscope at 100× magnification usually, although up to 300× could be used. W.D.F.

New microscopes. R. E. SEIDEL AND M. ELIZABETH WINTER. *Jour. Franklin Inst.*, **237**, 103–30 (1944).—The electron microscope uses a beam of electrons instead of light and has a useful magnification up to 25,000×, which may be further magnified to 100,000×. An ordinary light microscope has a useful magnification of 2000×. Bacteria examined by the electron microscope are necessarily killed. Lucas, Graton and Dane, and a few others have made optical microscopes with useful magnifications of about 6000×. These results are achieved by taking care to eliminate vibration and by a rigid construction. The Universal Microscope developed by Rife (San Diego, Calif.) in 1933 is a light microscope which has over 5000 parts and weighs 200 lb.; it has a useful magnification of 31,000× and a total magnification of 60,000×. The fine adjustment is 700 times more sensitive than that of an ordinary microscope and takes 1.5 hr. to turn from one limit to the other. W.D.F.

Polarizing accessories for microscopes. C. D. WEST, *Jour. Chem. Education*, **19** [2] 66–69 (1942).—The common medical microscope can be converted into a polarizing instrument by the application of Polaroid accessories. An analyzer, consisting of a 0.75-in. laminated disk of Polaroid, can be fitted into the bottom of the eyepiece tube. This position is preferable to that of a cap analyzer on top of the ocular. For interference figures a pinhole aperture is recommended for the top of the body tube, and instructions are provided for modification of the condenser assembly. Advice is given for checking the objectives for strain, as the average medical microscope is not provided with strain-free objectives. It is recommended that a circular stage be purchased. The polarizer is made part of the source of illumination, thus eliminating excessive crowding of the substage assembly. The operation of such a modified microscope is discussed. 10 references. S.Z.

Radiant heat. JAMES D. HALL. *Paper Trade Jour.*, **114** [10] 35–39 (1942).—The fundamentals of radiant heating are discussed with practical suggestions for the application of this new tool of industry. W.R.B.

Recording instruments for dynamic elongation measurements. Dynamic elongation recorders for large structural parts. E. LEHR. *Arch. Tech. Messen*, No. 139, T 7 . . . 9 (1943); abstracted in *Z. Instrumentenk.*, **63** [11] 401–404 (1943).—Dynamic elongation meters record the elongation of a definite length as a function of time on a larger scale without distortion. The different solutions of this problem with mechanical, photographic, and electric devices for stationary and moving objects are described. The advantage of the last group (electric) is that they can be used remote from the actual object and place of measurement and measure several places simultaneously with multiple oscillographs. Only instruments based on changes in resistance, not on changes in capacity, have been successful. M.HA.

***Significance of roentgenography for studying the structure of ceramic masses and products.** ANON. *Tonind.-Ztg.*, **67** [5/6] 42–43 (1943).—Literature on this subject is reviewed in connection with the 20th anniversary of Röntgen's death. M.HO.

Temperature compensation. H. SHERMAN. *Electronics*, **17** [4] 125 (1944).—An analysis of the uncompensated temperature error occurring in variable frequency tank circuits employing ceramic capacitors for compensation is presented. H.T.

Variable angle surface illuminator. JOHN H. GRAFF. *Paper Trade Jour.*, **115** [22] 97–101 (1942).—G. deals with the variable angle surface illuminator, which is a microscope illuminator for photographic and visual inspection of materials. Visual comparisons of surface textures can be made by photographing comparable materials at a given angle of incidence. W.R.B.

Welding saves $3515 in storage-bin construction. ANON. *Ceram. Ind.*, **42** [3] 49–50 (1944).—A silo-type tank for storing glassmaking materials combines five bins in one structure. Illustrated. H.T.

PATENTS

Apparatus for feeding tile to spraying machines. W. O. BENNING (Pacific Clay Products Co.). U. S. 2,347,391, April 25, 1944 (May 30, 1942).

Apparatus for transferring granular material. C. F. GEIGER, C. P. CLAPP, AND W. C. KEMPF (Carborundum Co.). U. S. 2,346,743, April 18, 1944 (Jan. 22, 1940).

* Obtained from microfilm.

Electrical dust precipitator. G. W. PENNEY (Westinghouse Electric & Mfg. Co.). U. S. 2,347,709, May 2, 1944 (March 12, 1941).

Electron microscope. LADISLAUS MARTON (Radio Corp. of America). U. S. 2,347,328, April 25, 1944 (June 30, 1942).

Electron microscope object chamber. C. J. YOUNG (Radio Corp. of America). U. S. 2,347,348, April 25, 1944 (June 30, 1942).

Hydraulic press control. W. J. SNYDER (Defiance Machine Works, Inc.). U. S. 2,346,141, April 11, 1944 (May 2, 1941).

Manufacture of earthenware, etc., molded from plastic material. A. TILSTONE. Brit. 559,925, March 22, 1944 (Oct. 9, 1942).

Means for reducing the dwell in hydraulic presses. P. E. FLOWERS (Hydraulic Development Corp., Inc.). U. S. 2,346,212, April 11, 1944 (Sept. 27, 1940).

Platen control device. P. E. FLOWERS (Hydraulic Development Corp., Inc.). U. S. 2,346,214, April 11, 1944 (May 7, 1941).

Process and apparatus for separating fragmentary materials. G. J. HOLT, VICTOR RAKOWSKY, AND R. W. ARMS (Minerals Beneficiation, Inc.). U. S. 2,347,264, April 25, 1944 (Oct. 21, 1940).

Kilns, Furnaces, Fuels, and Combustion

Coal research progresses. ANON. *Heating & Ventilating*, **41** [4] 70 (1944).—Work done during 1943 and reported by Bituminous Coal Research, Inc., is summarized. The problems of production and utilization of coal are being studied by the Bureau of Mines, Illinois Geological Survey, West Virginia School of Mines, Pennsylvania State College, Carnegie Institute of Technology, and Battelle Memorial Institute. M.R.

***Concept of heat.** J. N. BRØNSTED. *Kgl. Danske Videnskab. Selskab, Math.-fys. Medd.*, **19** [8] 3–79 (1941); abstracted in *Physik. Ber.*, **23** [12] 1210–11 (1942).—B. develops a new concept of heat, an "energetic theory," in which he distinguishes between "basic processes" (transport of certain "energetic quantities" from one state to another) and "generating processes" of such quantities. The classical concept that heat also enters into energy transformations is considered to be without foundation. The concept of heat as a kind of motion or energy of the molecular motion is considered as irreconcilable with the classic theory. M.HA.

Investigate uses of anthracite fines. ANON. *Heating & Ventilating*, **41** [4] 51 (1944).—To utilize an annual surplus of one million tons of fine anthracite particles, the Bureau of Mines is studying the problem. Methods of burning the fines and of briquetting them will be considered. For the latter, the use of idle brickmaking equipment is contemplated. M.R.

***Kilns for small brickyards.** C. KABUS. *Tonind.-Ztg.*, **67** [1/2] 3–6; [3/4] 26–28 (1943).—Kilns suitable for small brickyards are described. The construction, operation, efficiency, etc., of these kilns is discussed. M.HO.

Masonry chimneys more durable than steel. ANON. *Brick & Clay Record*, **104** [2] 32–33 (1944).—To prevent excessive expansion of chimneys at the base, insulating brick such as Sil-O-Cel are used. Stacks used for dissipating corrosive fumes are lined with acidproof brick; glass-wool insulation may be applied between the lining and the shaft. B.C.R.

Microanalysis of solid fuels: I, Proximate analysis and determination of carbon dioxide. R. BELCHER AND C. E. SPOONER. *Iron & Coal Trades Rev.*, **148** [3960] 79–80, 91 (1944).—A brief review and a description of the apparatus and methods available are given. **II, Ultimate analysis.** *Ibid.*, [3961] 134–36.—Methods and apparatus for the determination of C, H, N, and S are discussed. **III, Microanalysis of gaseous fuels.** *Ibid.*, [3962] 165–66.—Methods and apparatus for analyzing gaseous fuels are described. Three main types are used: low-pressure methods, low-temperature distillation methods, and the capillary burette type. See "Rapid. . .," *Ceram. Abs.*, **21** [6] 130 (1942). M.HA.

Pulverized fuel for heating furnaces and metallurgical furnaces. L. S. WILCOXSON. Presented at meeting of Assn. of Iron and Steel Engineers, Pittsburgh, Sept., 1943; abstracted in *Ind. Heating*, **10** [11] 1646–52 (1943).—Pulverized coal can be used in place of either gas or oil with the same facility in certain types of work. The coal used should have an ash with a fusing temperature higher than the operating temperature of the furnace so that a dry ash results; the ash content is relatively unimportant. The lower the S content, the better. Grindability is important, as high fineness is most desirable. At least 70% of the pulverized material should pass through 200-mesh. The various systems for handling pulverized coal are described. M.HA.

Separation and transportation of coal dust as pulverized fuel. H. C. RAY. Presented at meeting of American Institute of Mining and Metallurgical Engineers, St. Louis; abstracted in *Combustion*, **15** [2] 42 (1943). H.E.S.

Sulfur removal from gases. Report of Committee of Enquiry on Sulfur Removal, Institution of Gas Engineers (London). *Gas Jour.*, **240** [4143] 58–61 (1942).—After H_2S is removed from city gas, there remain CS_2, thiophenes, mercaptans, and COS, which, on burning, generate SO_2 and SO_3 in the ratio of 3–5 to 1. These gases may corrode the appliances, especially if the vapors are condensed as in water heaters; there is an odor if the gases are present to the extent of 0.00002% (SO_3) or 0.0002% (SO_2). If the S content of the gas is reduced below 3 grains per 100 cu. ft., a flueless room heater will not create a perceptible sulfurous smell under normal defined conditions. Clouding is produced in the table working of glass if the gas is of high S content, and a low content is required for gas-fired ceramic kilns with open setting. The processes in use in Great Britain are (1) oil washing, (2) absorption by active carbon, and (3) a catalytic process. The catalytic process reduces the S content to 3 gr. per 100 cu. ft. and is equally suited to purified water gas and producer gas. No process can remove all of the S, but an experimental catalytic process reduces it to 1 gr. per 100 cu. ft. The Committee recommends that S in excess of 10 gr. per 100 cu. ft. be not permitted and prefers the lower limit of 3 gr. per 100 cu. ft. L.R.B.

***Use of gas generators in the cement industry.** A. LEONHARD. *Zement*, **32** [11/12] 108–11 (1943).—L. discusses the use of various gas generators for operating cement plants. Charcoal, peat, brown coal, anthracite, and other gas generators are considered. The cost is compared with the cost when oil is used for generating power. M.HO.

What's happening inside your kiln? XXI, Stokers. L. R. WHITAKER. *Brick & Clay Record*, **104** [1] 21 (1944).—To prevent fusing of retorts of stokers due to failure of air supply, W. suggests the use of a separate fan with a duct system for supplying air to all stokers, thus replacing the individual fans on each installation. Proper fuses for motors will eliminate burned-out windings. This may be accomplished by the use of a dual fuse system, the higher capacity fuse being used merely for starting the motors and the lower capacity one for use after the motor reaches a constant speed. **XXII, Cooling.** *Ibid.*, [2] 22–23, 25.—The degree of vitrification is a factor in determining the proper cooling rate. Flashed and glazed ware carry strains and should be annealed carefully in the cooling cycle. In downdraft kilns, cold air should be allowed to pass through the flue and the floor before contacting the heated ware, thus preventing unheated air from outside from striking the hot ware. For Parts **XVIII–XX** see *Ceram. Abs.*, **23** [2] 44 (1944). B.C.R.

* Obtained from microfilm.

SEPARATE PUBLICATION

Precision of the Volatile-Matter Determination for Anthracite, Low-Temperature Coke, and Subbituminous Coal. W. A. SELVIG. *U. S. Bur. Mines Rept. Investigations*, No. 3739, 6 pp. (Dec., 1943). Free.—Differences obtained in duplicate determinations of volatile matter for a large number of samples analyzed in the Bureau of Mines laboratories show that permissible differences between duplicate determinations for these fuels as specified in the standard methods of the A.S.T.M. are too stringent. R.A.H.

Geology

Brazil's bauxite deposits. ANON. *Chem. Age* [London], **49** [1258] 142 (1943).—Plants are being constructed at Ouro Preto, Minas Geraes, and other places in Brazil. One will use 12,000 tons of bauxite yearly. Hydroelectric power will be used, and the chief product will be aluminum. A.B.S.

***Brick clays of Holland.** K. ZIMMERMANN. *Ber. Deut. Keram. Ges.*, **24** [4/5] 145–62 (1943).—A detailed description of clays found in Holland and their chemical and physical properties, etc., are given. M.Ho.

British fluorspar. A. G. BENNETT *Chem Age* [London], **49** [1272] 490–91 (1943).—On Sept. 27, 1943, English fluorspar producers formed the Derbyshire Fluorspar Producers Assn. This Association aims at increased efficiency in production, greater use of beneficiation equipment, and more scientific use of flourspar in various industries. Of the 34 producers of fluorspar, 17 are without jigs, 16 without washing plants, and 19 have no crushers. Owing to the smallness of some of the firms, skilled labor is often wastefully used, marketing has been seriously neglected, and sales are unduly restricted because of lack of adequate treatment of the mineral. Prewar production was 33,000 tons per year, but present production is three times this amount and all customer requirements are now being satisfied. It is intended to extend the membership to include producers in Durham, Yorkshire, and elsewhere with a view to exporting fluorspar. The available deposits are large, sufficient to warrant a large export trade after satisfying all British requirements, and there is an abundance of highly skilled labor. The prospects of the industry, under the new arrangement of central control by the industry, are bright. A.B.S.

British nonferrous materials: quartz, sandstone, and sand. W. H. REYNOLDS. *Chem. Age* [London], **48** [1247] 549–52 (1943).—The chief properties of quartz, sandstone, and some sands and some of their uses are briefly mentioned. R. suggests that some glassmaking sands can be improved by removing the under 36-mesh grains, which contain most of the color-producing impurities. Sands too fine for glassmaking can be similarly improved by removing the under 120-mesh particles. Refractory sands occurring irregularly in hollows in the carboniferous limestones of Staffordshire and Derbyshire and the quartz pebbles associated with them are mentioned. The pebbles may be used for glassmaking after crushing and treatment with a reducing gas to convert the ferric oxide into magnetite and so facilitate its removal. The cost of purification becomes excessive unless special attention is paid to details, and great improvements in present methods are practicable. The Fairlight sand near Hastings can, by suitable treatment, be made equal in quality to the Fontainbleau sand which is no longer available. Other sands capable of great improvement by suitable treatment are at Aylesbury, Aylesford, Biddulph, Reigate, Kings Lynn, and North Lincolnshire. Sand-lime brick may be needed in much greater numbers to meet the postwar demand. Hitherto, too little attention has been paid to details of selecting and grading the sand and the selection of suitable hydrated lime. A small proportion of under 120-mesh particles of sand is recommended. A.B.S.

Ceramic materials. ANON. *Ceram. Ind.*, **42** [1] 42–132 (1944).—This issue of *Ceramic Industry* is a directory of materials used in the manufacture of ceramic articles. Detailed descriptions of their properties and functions in ceramic mixes are given. The materials are published in alphabetical order. Ceramic batches, glazes, and glasses are included. H.T.

Effect of concentration and pH on the viscous and electrochemical properties of hydrogen bentonites. J. N. MUKHERJEE, N. C. SEN GUPTA, AND M. K. INDRA. *Jour. Phys. Chem.*, **47**, 553–77 (1943).—The specific conductivities, cataphoretic velocities, pH, extinction coefficients, viscosities, and apparent specific gravities of three hydrogen bentonites at various concentrations were measured, and curves showing the variations of these properties with concentration are given. The results suggest that, as concentration rises, aggregates are first formed, which at still higher concentrations form some sort of structure that has a yield value. The buffer capacities of the clays are correlated with their variations in yield value, and consistency and thixotropy with pH. R.A.G.

Electrochemical properties of clay minerals and the differentiation of hydrogen clays and bentonites by electrochemical methods: I, Kaolinite and kaolinitic clays. J. H. MUKHERJEE, R. P. MITRA, AND D. K. MITRA. *Jour. Phys. Chem.*, **47**, 543–49 (1943).—Titration curves are given for the mineral kaolinite and for two hydrogen clays prepared from kaolinitic soils. The curve for hydrogen kaolinite has a weak dibasic acid character, and the base-exchange capacities at the two points of inflection are given for lime, baryta, and caustic soda. The titration curves for the hydrogen clays resemble the curve of a weak monobasic acid with caustic soda but have a stronger acid character toward baryta and lime. After free inorganic oxides are removed, one clay behaves like kaolinite and has similar base-exchange capacities, but the other still has a monobasic character. This latter clay is assumed to contain clay minerals belonging to a group other than kaolinite. **II, Montmorillonite clays and bentonites.** R. P. MITRA, S. N. BAGCHI, AND S. P. RAY. *Ibid.*, pp. 549–53.—A similar study is made of one hydrogen clay and two hydrogen bentonites which gave dehydration curves similar to those of montmorillonitic clay minerals. R.A.G.

Flotation treatment. E. N. POOR AND H. A. WHITENIGHT. *Paper Trade Jour.*, **114** [9] 21–24 (1942).—The authors deal with the use of pure fatty acids and natural fat soaps in the flotation of white waters containing both clay and clay-fiber mixtures. Curves. W.R.B.

Fluorspar in Derbyshire, England. W. BRAITHWAITE. *Chem. Age* [London], **48** [1252] 673–74 (1943).—The chief source of fluorspar for some years has been refuse heaps left by lead miners, and these still constitute an important source. Recently, some of the old lead (galena) mines have been reopened, and additional sources have been found by prospecting. Fluorspar for metallurgical purposes (about 85% CaF_2) is obtained by washing and crushing. The smallest particles (formerly lost) are now separated by flotation and are then briquetted. For the ceramic and chemical industries (guaranteed 95% CaF_2), the fluorspar is crushed to a powder (— 48-mesh) and separated by flotation. The final product, averaging 97 to 98% CaF_2, cannot be briquetted, as the binder needed would reduce the fluoride content. A.B.S.

Golden Manitou—new zinc producer. ANDREW ROBERTSON AND D. A. LIVINGSTONE. *Eng. Mining Jour.*, **145** [3] 74–79 (1944).—The mine is 8 miles east of Val d'Or in Quebec and is the eastern end of a hundred-mile chain of mines running to Kirkland Lake. The ore occurs in elongated lenses replacing sericite schist; it contains 7.5% zinc, a little gold and silver, and traces of lead and copper. Sphalerite is the most abundant ore mineral, followed by pyrite, arsenopyrite, chalcopyrite, tennantite, galena, and tetrahedrite. There is a quartz and carbonate gangue.

* Obtained from microfilm.

Mining is done by shrinkage methods; the deepest level is at 1110 ft. The ore is treated by flotation concentration and cyanidation. Three products are made, a zinc concentrate, a lead concentrate, and a gold-silver concentrate. Recovery of the zinc is 92%. The total operating cost per ton is $3.74. W.D.F.

Igneous rocks of the northern Big Belt Range, Montana. JOHN B. LYONS. *Bull. Geol. Soc. Amer.*, **55** [4] 445–72 (1944).—L. describes potash-rich basalts comprising extrusive orthoclase basalts and analcime trachybasalts and intrusive rocks grading from gabbros to quartz monzonites. Crystal settling was the dominant cause of differentiation. Analcime phenocrysts up to 5 mm. in diameter seem to be of primary origin. The groundmass of most of the rocks is zeolitized. A large dike swarm radiating from a composite stock was emplaced laterally and not vertically. A.C.B.

New procedure for detecting acidity. FRITZ FEIGL AND PAULO E. BARBOSA. *Ind. Eng. Chem., Anal. Ed.*, **14,** 519–21 (1942); abstracted in *Chem. Age* [London], **47** [1206] 131 (1942).—Zeolites and kaolins give a positive color with a saturated solution of silver chromate in ammonia, while muscovite, talc, and other aluminosilicates do not. Precipitated silica, even after ignition, also gives a color, but quartz does not. A.B.S.

Origin of igneous rock types. ARTHUR BRAY. *Mining Mag.*, **70,** 17–21 (1944).—A magma, if large enough, may differentiate into many different types of rocks. Chemical and mineralogical analyses may be used to show whether or not a series of rocks came from the same magma. With chemical analyses, the silica is plotted on the abscissa, and any other component, such as alumina, on the ordinate. If they are from the same magma, the points should lie on a straight line. Other components are treated similarly. Rocks from the same magma may have a charcteristic mineral, such as analcite. Extreme differentiates may have the complementary rock near by. Causes of differentiation are fractional crystallization, gravitational separation, immiscible sulfides, and expulsion of the residual melt by pressure. W.D.F.

pH determinations of water in contact with stones. H. G. WILLIAMS. *Jour. Soc. Chem. Ind.* [London], **62** [12] 209–13 (1943).—Asphaltic bitumen adheres better to limestone than to flint or quartzite, so that it has been supposed that alkaline stones will always adhere well. Samples of granite, limestone, quartzite, gravel, and shingle from England and France were kept under ordinary distilled water in Pyrex bottles, and the pH was determined by the glass electrode at intervals and compared with a blank. All the stones except quartz from Manche, France, made the water alkaline. The latter gave pH = 4 after 485 days. The smaller the size of stone, the quicker the ultimate pH was attained. The alkalinity is ascribed to Na_2CO_3 present throughout the stone, but in limestone to $Ca(OH)_2$. The radicals present in the water were qualitatively detected. L.R.B.

Phosphate, barites, and other minerals felt stimulus of war demand in 1942. ANON. *Pit & Quarry*, **35** [7] 95–103 (1943).—According to the U. S. Bureau of Mines, 1942 set all-time high records in the sales of barites, phosphate rock, industrial clays, fluorspar, potash, and sulfur. Figures are not yet available covering the sales of mica, graphite, bauxite, magnesite, feldspar, talc, and other minerals, but it is believed that they too have set records. Phosphate, gypsum, lime and dolomite, industrial sand, slag, bitumized aggregates, industrial clays, and some of the critical minerals are discussed at length with comments on some of the plant developments in the various fields. M.R.

***Regulations concerning prospecting and processing of minerals.** KURT STÖCKE. *Tonind.-Ztg.*, **67** [5/6] 37–38 (1943).—The government order concerns (1) clays for refractory and acidproof products, ceramic products (excepting brick), alumina, and glazing clays; (2) fuller's earth and bentonite; (3) kaolin; (4) feldspar and pegmatite sand; (5) mica; (6) quartzite and quartz in so far as required for refractories and for ferrosilicon; (7) magnesite; (8) bauxite; (9) fluorspar; (10) heavy spar; (11) talc and steatite; and (12) diatomaceous earth. The implications of this order for mines and the ceramic industry are discussed. M.Ho.

Survey of the literature on plasticity, viscosity, and allied properties. PAUL G. HEROLD AND W. J. SMOTHERS. *Bull. Amer. Ceram. Soc.*, **23** [5] 184–88 (1944).—85 references, 2 figures.

Use of zeolites in boiler-water treatment. D. D. HOWAT. *Chem. Age* [London], **48** [1241] 387–92 (1943).—Various naturally occurring minerals, such as zeolites, glauconites, greensands, and fuller's earth, possess the property of base exchange. The significant constituent is the hydrated double silicate $Na_2O \cdot 2SiO_2 \cdot Al_2O_3 \cdot 6H_2O$, in which sodium is exchanged for calcium or magnesium ions present in the water, thus forming the corresponding highly soluble sodium salt. Later, the material is regenerated by treatment with a 4 to 7% solution of salt. Two methods of preparation may be employed for the production of synthetic zeolites. (1) The fusion process, in which the quartz, clay, feldspar, and soda are mixed together, fused, and then ground to suitably sized particles. The product* is a hard compact material possessing a small surface area relative to the mass, while the reaction activity is low. This process is not extensively used. (2) Chemical reaction and precipitation, e.g., kaolin, hydrated sodium silicate ($Na_2SiO_3 \cdot 5H_2O$), and quartz flour in approximately equal proportions are intimately mixed by fine grinding in a ball mill. The product, mixed with 18% by weight of water, is allowed to set hard. The brick are steamed in an autoclave at 30 lb. per sq. in. until the product no longer gives an alkaline reaction. After fine grinding, the fraction between 10- and 50-mesh is used. Alternatively, sodium silicate and sodium aluminate solutions react to form aluminosilicate gel, which is mechanically dried by pressure between two continuous filtering webs to form a thin sheet with a high surface activity and very strong exchange properties. Treated minerals and synthetic zeolites have the following defects: (*a*) The efficiency falls off markedly with increase of temperature above 50°C. (*b*) They tend to increase the silica content of the treated water working at elevated temperatures. Effective base-exchange media may be produced from naturally occurrring carbonaceous materials. The carbonaceous zeolites and synthetic resins possess the following advantages over zeolites: (1) No increase takes place in the silica content of the treated water. (2) The exchangers are not destroyed either by acid or alkali and will operate on waters of widely varying pH value. (3) The resins in particular may be manufactured in a porous open gel form in which the exchange activity is largely independent of the surface area. (4) Owing to the low specific gravities, the beds in the softeners may be turned over and expanded during regeneration at rates of flow considerably slower than are possible for zeolites. (5) Attrition losses are much smaller, the lattice of the materials being highly elastic and capable of accommodating volume changes up to 25% without disruption. (6) Increased exchange capacity is obtained by operating the resins at higher temperatures. Some of the carbonaceous zeolites and resins have a tendency to color the water. A.B.S.

Vermiculite. ANON. *Chem. Age* [London], **49** [1257] 1191 (1943).—Vermiculite (an alteration product of biotite micas) varies in color from white to yellow, brown, bronze, and green. Its most important property is its expansion, when heated, to about 20 times its original volume, the specific gravity being reduced from 2.5 to 0.09 or less. In this condition it weighs 6 to 20 lb. per cu. ft. World production of the mineral dates from 1923, when it was planned to work a deposit in Colorado and to use the treated product as an insulating material for steam pipes, refrigerating equipment, insulating brick, wall boards, etc. At about the same period plans were also made to work a deposit in Montana to produce the exfoliated material for use as an aggregate in magnesium oxychloride cement products or as a lightweight fireproof substitute for insulating cork. A.B.S.

* Obtained from microfilm.

SEPARATE PUBLICATIONS

Beneficiation of Del Monte (Calif.) Sand. JOHN DASHER, ROBERT R. ROUGH, AND FRANK L. BACON. *U. S. Bur. Mines Rept. Investigations*, No. 3740, 10 pp. (Dec., 1943). Free.—Tests made to produce a material suitable as a source of silica for a flint glass of good color are described. R.A.H.

Minerals Yearbook, 1941. U. S. BUREAU OF MINES. 1573 pp. Supt. of Documents, Govt. Printing Office, Washington, D. C. Price $2.25.—This edition, until now classified confidential and available only for use by Federal war agencies, is being made public. R.A.H.

Wyoming Vermiculite Deposits. ARTHUR F. HAGNER. *Geol. Survey Wyoming Bull.*, No. 34, 47 pp. (March, 1944). —The commercial vermiculite deposits of Wyoming are described, and brief mention is made of other prospects in the state. The known Wyoming deposits occur associated with pre-Cambrian igneous and metamorphic rocks in the eastern, southeastern, and central parts of the state. Commercial deposits are found in four districts, Encampment, Wheatland, Glenrock, and the Sweetwater Uplift. Commercial vermiculite has formed at the contacts of granite pegmatite with biotite and hornblende schists, metadiorite, hornblendite, and serpentinite. It is believed that the pegmatites contained sufficient volatile constituents to alter hornblende, biotite, and serpentinite to vermiculite by hydrothermal action. Data are presented on physical, chemical, and optical properties of vermiculite and on tests and specifications of the exfoliated product. The uses, mining methods, and treatment are briefly considered. Wyoming has produced between 5000 and 5500 tons of vermiculite, principally from the Encampment, Wheatland, and Glenrock districts. Some additional production is believed possible from these districts and perhaps from other regions where the mineral has been found but which are undeveloped at present.

Chemistry and Physics

Activated alumina. J. HARWOOD AND W. CULE DAVIES. *Chem. Age* [London], **50** [1288] 223–28 (1944).—Activated alumina completely adsorbs moisture from air and other gases until it has adsorbed 18 to 20% of its own weight of water; less efficiently, it can adsorb up to 35%. It is readily and repeatedly reactivated by heating to 175° to 250°C. and cooling. Four types of air driers are illustrated and briefly described. For air conditioning, activated alumina is superior to refrigerants and to adsorbents which cannot be readily reactivated. It is effective for drying numerous liquids, particularly refrigerants. In many cases it simultaneously removes colored impurities. The liquid may percolate through 16- to 30-mesh alumina, or finely powdered alumina may be stirred up with the liquid and the latter may afterward be filtered. Air dried by activated alumina may be used for dehydrating meat and vegetables and for drying delicate organic products without heating them. Powdered solids may be dried by mixing them with granular activated alumina and then separating the latter by screening. Activated alumina has a high adsorption for many organic compounds in the form of vapors and liquids. It bleaches crude animal, fish, mineral, and vegetable oils, waxes, and resins, and removes sulfur compounds and acids. For this purpose it is much superior to bauxite. It is particularly effective in reconditioning transformer oils and other oils while they are in use. Activated alumina is also used extensively in the chromatographic adsorption of dyestuffs. Thus, if an aqueous solution of Victoria blue, methyl violet, and auramine is allowed to percolate through a column of wet 100- to 200-mesh activated alumina slowly and followed by a further percolation of water, the alumina will show three bands of color, Victoria blue, methyl violet, and auramine in the order named. A separation of the dyestuffs is thereby effected. The efficiency of a sample of activated alumina can be determined by passing a known volume of air saturated with moisture over the sample in a weighed U tube and then through a weighed U tube packed with activated alumina of known quality impregnated with a cobalt salt. The air flow is adjusted to about 0.8 cu. ft. per hr. The U tubes are weighed (separately) at intervals. The sample should adsorb all of the moisture in the air until the sample has increased its weight about 18%. Afterward it will work less efficiently. A.B.S.

American Ceramic Society—Report of Committee on Standards. J. W. WHITTEMORE, *Chairman*. *Bull. Amer. Ceram. Soc.*, **23** [5] 165–68 (1944).

Anomalies of elasticity and flow and their interpretations. ROBERT SIMHA. *Jour. Phys. Chem.*, **47**, 348–63 (1943).—Elastic properties of glasses and high polymers, especially elastic relaxation, aftereffect, and creep, are considered mathematically. A few relaxation mechanisms are sufficient for an interpretation of the deformation-time curves of inorganic glasses, but for high polymeric materials a whole series of mechanical relaxation times must be assumed. The experimental determination of the relaxation spectrum is discussed. R.A.G.

Cation and anion interchange with zinc montmorillonite clays. M. M. ELGABALY AND H. JENNY. *Jour. Phys. Chem.*, **47**, 399–408 (1943).—Exchange adsorption isotherms are given for zinc chloride with sodium, calcium, and hydrogen bentonites. Zinc clays possess marked anion-exchange properties, and Cl, OH, and NO_3 ions are mutually replaceable. A mosaic surface is postulated for zinc clay capable of independent cation and anion exchange. Some of the adsorbed zinc exists in nonreplaceable forms. R.A.G.

Colloidal properties of aqueous dispersions of titanium dioxide. S. W. MARTIN. *Paper Trade Jour.*, **115** [4] 31–38 (1942).—M. discusses the colloidal properties of titanium dioxide and includes considerable material on the internal and external structure of titanium dioxide particles. W.R.B.

***Crystal photoeffect in highly insulating crystals: II, Diamond.** T. MENDELSSOHN AND H. DEMBER. *Rev. Faculte Sci. Univ. Istanbul*, Ser. A, **6** [1/2] 18–26 (1941); abstracted in *Physik. Ber.*, **23** [15] 1487 (1942).—Continuing previous measurements of the interior photoeffect (*ibid.*, **20**, 2222 (1939)), the effect was determined for diamond with a Hg lamp as the light source. The e.m.f. of the photoeffect shows in diamond a pronounced maximum at 550°C., while the current intensity in the investigated range of 400° to 700°C. increases exponentially from 2×10^{-13} to about 5×10^{-10} amp. These measurements, however, are not reproducible (as with ZnS) because each heating is followed by a "tempering" effect which apparently dislocates the electron bands. The yield of interior photoelectrons increases with the frequency of the light exponentially; in one crystal it was found to be 3.7×10^{-8} electrons per photon at 4340 a.u. and 6.7×10^{-5} at 2224 a.u. M.HA.

Determination of cobalt and its separation from nickel by the phosphate method. W. R. SCHOELLER. *Analyst*, **69** [814] 8–11 (1944).—Rapid and reliable procedures are described for the separation and determination of Co and Ni in any relative proportion, even extreme ratios. Iron is separated from Ni and Co by precipitation as ferric phosphate in an acetate solution. The procedures used are combination methods utilizing ammonium phosphate and dimethylglyoxime. Large amounts of Co are determined gravimetrically as pyrophosphate, and small amounts as oxide after precipitation as sulfide. B.C.R.

Determination of phosphorus in iron and steel by means of the Spekker photoelectric absorptiometer. An "arsenic-free" method. T. S. HARRISON AND W. FISHER. *Jour. Soc. Chem. Ind.* [London], **62** [12] 219–21 (1943).—P is determined as phosphovanadomolybdate after the removal of arsenic. L.R.B.

* Obtained from microfilm.

Determination of sodium in aluminum and its alloys. R. SMART. *Jour. Soc. Chem. Ind.* [London], **62** [12] 213–16 (1943).—Three methods for determining small quantities of sodium in Al and its alloys have been worked out. These depend on (1) zinc uranyl acetate, (2) dissolution in amyl alcohol (M. Koide), and (3) calcination of a lump at 900 °C., followed by leaching (modified Scheuer method). L.R.B.

Direct reaction of solids. F. FEIGL, L. I. MIRANDA, AND H. A. SUTER. *Jour. Chem. Education*, **21** [1] 18–24 (1944).—Solid-phase reactions involving color changes are discussed in two groups: (*A*) Reactions of a mixture of solids which proceed similarly by the dry or wet method include (1) action of MgO on anhydrous sulfates of Fe_3^+, Mn, Co, Cu, and Ni; (2) reduction of solid insoluble metal halides by Zn; (3) formation of colored lakes by the dry method (an organic substance, such as alizarin, is caused to react with the powder at low temperatures); (4) inner complex formation by the dry method, e.g., nickel dimethylglyoxime; (5) double decomposition of inner complexes; and (6) action of MnO_2 on solid HgI_2. (*B*) Reactions that occur only in the mixture of the solid reactants include (1) acid plus basic oxides; (2) reaction of an oxide of a divalent metal with the pyrophosphate or pyroarsenate of a divalent metal; (3) silicate formation by the dry method; (4) $PbSO_4$ plus Na_2CO_3; (5) oxidative decomposition of CuI by ZnO; (6) action of Se on $Hg(CN)_2$ and AgCN; (7) TlI plus $AgCrO_4$; and (8) HgI_2 plus CuI or AgI. Details of the conditions of the reaction, temperatures, etc., are given. References to the literature are given for each reaction. S.Z.

Electrical properties of solids: I. R. M. FUOSS. *Jour. Chem. Education*, **19** [4] 190–93 (1942).—The classical electrostatic theory recognizes two classes of solids—conductors and insulators. An ideal conductor can support no potential difference; an ideal dielectric is a medium capable of storing a charge under the influence of a potential. Materials deviate from these ideal definitions to varying degrees and in practice are classified as conductors (conductance is 10^3 reciprocal ohms/cm. or more), semiconductors, and insulators (conductance is 10^{-10} reciprocal ohms/cm. or less). As conductance is related to the ion or electron movement within the body, it depends on the nature of the lattice or molecule and also on the character of the applied potential, whether a.c. or d.c. The classical and the modern theories of conductance are compared. Conductors and semiconductors are discussed in the light of the modern theory. **II.** *Ibid.*, [5] 231–33. The subject of the electrical properties of insulators is introduced by a discussion of the Debye theory of dispersion in liquids. The influence of group linkages and polymerization is mentioned. S.Z.

Fundamental study of clay: VI, Flow properties of kaolinite-water suspensions. F. H. NORTON, A. L. JOHNSON, AND W. G. LAWRENCE. *Jour. Amer. Ceram. Soc.*, **27** [5] 149–64 (1944).—15 references, 11 figures. For Part **V** see *ibid.*, [3] 77–80.

Magnetism and molecular structure. P. W. SELWOOD. *Jour. Chem. Education*, **19** [4] 181–88 (1942).—The measurement of magnetic susceptibility by classical and modern instruments is described. As a review of the modern concepts of magnetism, recent work on organic and inorganic solids is discussed. S.Z.

Mechanism of the mutual coagulation process: III. HARRY B. WEISER AND W. O. MILLIGAN. *Jour. Phys. Chem.*, **47**, 424–36 (1943).—When two hydrophobic sols of opposite charge are mixed, mutual adsorption takes place accompanied by displacement of counter ions of the electrical double layer, which may be estimated potentiometrically. Ferric oxide sols were mixed with sols of cupric ferrocyanide, arsenic trisulfide, stannic oxide, and Congo red acid. In most of these combinations, hydrogen ions were the chief stabilizing ions of the positive sols and the counter ions of the negative sols. Because of strong adsorption of hydrogen ion by ferric oxide, the hydrogen-ion activity of the sol mixtures decreases to a minimum well below that of either sol alone, while the chloride ion activity of the mixtures increases. A mixture of Sorum ferric oxide sol and Congo red acid behaves differently from the other combinations in that the hydrogen-ion activity as well as the chloride-ion activity increases to a maximum well above that of either sol alone. This is due to the mutual adsorption of ferric oxide and to the fact that the colloidal anion is sufficiently great to displace hydrogen ions from the inner layer of the ferric oxide particles or at any rate to cut down the adsorption of these ions displaced from the dye sol. R.A.G.

Rapid determination of arsenic in glass. H. N. WILSON. *Analyst*, **68** [813] 361–64 (1943).—A rapid and accurate method of determining arsenic in glass is given: Fuse 0.5 to 1.0 gm. of glass with 3 to 5 gm. of NaOH in a silver or nickel crucible. Cool and extract with 30 to 40 ml. of water. Transfer to a distillation flask containing 20 ml. of concentrated HCl and 30 ml. of water with one garnet to stop bumping. Add 10 ml. of a 5 to 10% solution of hydrazine hydrate acidified with HCl together with 0.25 gm. of KBr. Distill rapidly. When half of the liquid has been distilled, add concentrated HCl until the temperature rises to 110 °C. and then 50 ml. of HCl in addition. Distill until 50 ml. remains in the flask. If this distillate contains appreciable As, make a third distillation. Transfer the first di tillate to a 500-ml. flask; cool and add 5 to 10 ml. of CCl_4 and 2 ml. of $N/50$ arsenious oxide. Titrate with $M/200$ KIO_3 solution. The end point is the disappearance of color from the CCl_4 layer. Vigorous shaking is essential. Add the second distillate and titrate. $M/200$ KIO_3 (ml.)/10 = As_2O_3 (1.0-gm. sample). For samples containing more than 2% As_2O_3, use a $M/80$ or $M/40$ KIO_3 solution. Antimony causes no interference. B.C.R.

Review of microvolumetric apparatus. G. H. WYATT. *Analyst*, **69** [816] 81–89 (1944).—67 references. B.C.R.

Transparent phase-rule model. LIU-SHENG-TS'AI. *Jour. Chem. Education*, **19** [1] 2 (1942).—Details are given for the construction of a three-dimensional model to illustrate the pressure-temperature-composition relations within a binary system. The model has a wooden base slotted at regular intervals to contain transparent sheets of Cellophane or Pliofilm on which are inked the *P-T* diagrams for a particular composition in the binary system. The system KCl–water is given as an example. S.Z.

Use of photoelectric spectrophotometric techniques in chemical analysis. J. W. STILLMAN. *ASTM Bull.*, No. 125, pp. 17–19 (Dec., 1943).—In a satisfactory colorimetric method, the following requirements must be met: (1) Color produced by the reagent must be characteristic of the constituent being determined. (2) The color must be produced in reasonable intensity by small amounts of the constituent being determined. (3) The color must be stable for a sufficiently long time to permit its measurement. (4) Salts produced in the preparation of the sample must be properly compensated for if their presence influences the results. (5) The density of the color should be proportional to the concentration of the constituent being determined. As an instrument designed for greatest accuracy is expensive, its costs cannot be justified for routine applications, but instruments of simpler design are available for such work. B.C.R.

Vitreous state: some semiquantitative considerations. MAURICE L. HUGGINS. *Jour. Phys. Chem.*, **47**, 502–11 (1943).—The equilibrium which exists between the crystalline and the noncrystalline conditions in a substance and the rate of attainment of the crystalline state are discussed in terms of the energy changes occurring at minor structural rearrangements, the activation energies for such rearrangements, and the temperature. The theory is applied to a silicate glass where the rate of rearrangement of the silicon-oxygen bonds depends on the temperature and the viscosity of the glass. Slow cooling gives a glass at room temperature which approaches the lowest possible energy and is therefore stable, whereas rapid cooling results in strains and inhomogeneities. See *Jour. Amer. Ceram. Soc.*, **26** [12] 393–98 (1943). R.A.G.

X marks the spot (Hillier electron microanalyzer). ALBERT G. INGALLS. *Sci. Amer.*, **170**, 163–65 (1944).—The Hillier electron microanalyzer allows chemical analy-

sis of minute spots revealed by the electron microscope, spots as small as 0.00001 in. in diameter. (1) The spot is located by the electron microscope. (2) It is centered. (3) The microscope is adjusted so that all the electrons pass through this spot in a narrow probe, instead of spreading out as usual. The electrons emerge from the spot with different velocities, according to the nature of the atoms penetrated; e.g., electrons passing through carbon have a different speed than those going through potassium. (4) Finally a velocity analyzer is switched on; it is an electromagnet producing a homogenous magnetic field. High-velocity electrons make a large U turn, strike a photographic plate, and make a line; slower ones make a smaller turn and make an adjacent line. The position of these lines is characteristic of the chemical elements in the spot; unavoidable scattering of some electrons makes a weak background for the lines. This method is only qualitative as yet and has been worked out only for the lighter biologically important atoms. W.D.F.

X-ray studies of hydrous oxides: IX, Scandium oxide monohydrate. H. B. WEISER AND W. O. MILLIGAN. *Jour. Phys. Chem.*, **42**, 669–72 (1938).—The addition of alkalis to solutions of scandium salts at 25° and 100°C. throws down white, highly hydrous precipitates which give isobaric dehydration curves corresponding to hydrous $Sc_2O_3 \cdot H_2O$. The X-ray diffraction pattern of $Sc_2O_3 \cdot H_2O$ is distinctly different from that of anhydrous Sc_2O_3 but similar to that of $Al_2O_3 \cdot H_2O$. The alleged compound $(2Sc(OH)_3) \cdot H_2O$ of Sterba-Bohm and Melichar is probably $Sc_2O_3 \cdot H_2O$. There is no indication of a second modification of Sc_2O_3 between 450° and 900°C. For Part **X** see *Ceram. Abs.*, **22** [6] 108 (1943). R.A.G.

PATENTS

Ceramic pigment. C. J. HARBERT (Harshaw Chemical Co.). U. S. 2,347,630, April 25, 1944 (July 23, 1941).—A process for forming an iron-silica ceramic pigment including the steps of forming a gel by reacting an inorganic water-soluble ferric compound and an acid with a soluble alkaline silicate in proportions capable of yielding a composition of empirical formula $Fe_2O_3 \cdot xSiO_2$, where x is of such value that the Fe_2O_3 is not more than 15% of the combined weights of Fe_2O_3 and SiO_2, and water in gel-forming quantity, drying, washing, and calcining.

Chalk-resistant titanium dioxide pigment and method for preparing it. W. K. NELSON (National Lead Co.). U. S. 2,346,322, April 11, 1944 (May 2, 1941).—A chalk-resistant titanium dioxide pigment comprising particles of a titanium dioxide pigment intimately associated with a chromium compound resulting from the reaction of a water-soluble chromium salt and an alkaline-reacting precipitating agent, a white water-insoluble metal silicate, and alumina, the amount of the chromium compound being between about 0.03% and 0.07%, calculated as chromium, Cr, the amount of the white metal silicate being between about 1.0% and 3.0%, and the amount of aluminum hydrate, calculated as Al_2O_3, being between about 0.75% and 1.25%, based upon the weight of pigment particles.

Colored titanium pigment. H. H. SCHAUMANN (Canadian Industries, Ltd.). Can. 418,851, March 7, 1944 (April 8, 1939). G.M.H.

Colored titanium pigment production. H. H. SCHAUMANN (Canadian Industries, Ltd.). Can. 418,855, March 7, 1944 (Aug. 20, 1940). G.M.H.

Manufacture of calcium chromate. L. F. LE BROCQ AND H. G. COLE. U. S. 2,346,493, April 11, 1944 (Aug. 12, 1943).—A method of producing calcium chromate by a chromic acid-calcium hydroxide reaction consisting in adding to the chromic acid solution a quantity of calcium hydroxide less than is stoichiometrically required to convert the whole of the chromic acid to calcium chromate and so as to form a solution containing calcium dichromate, cooling the solution below 20°C., then adding further calcium hydroxide to produce a solution containing a freely soluble calcium chromate, and maintaining the solution during the further addition and completion of the reaction at a temperature below 20°C.

Preparation of calcium titanate. HELMUT ESPENSCHIED (National Lead Co.). U. S. 2,346,296, April 11, 1944 (Oct. 24, 1941).—Method for preparing improved pigmentary calcium titanate which comprises forming a reaction mixture of a reactive titanium compound, a reactive calcium compound, between about 0.5 and 2.0% of silica, between about 0.5 and 3.0% of an oxide of antimony, and between about 3.0 and 7.0% of magnesia, all percentages being based on the weight of the reaction mixture, and heating the reaction mixture at temperatures between about 850° and 975°C. until substantially complete formation of calcium titanate is attained.

Purifying crude sodium carbonate. A. C. HOUGHTON (Frederic A. Dakin). U. S. 2,347,053, April 18, 1944 (Feb. 7, 1940).

Rutile titanium dioxide. S. S. COLE (Canadian Titanium Pigments, Ltd.). Can. 418,859, March 7, 1944 (Dec. 31, 1937). Can. 418,860 and 418,861, March 7, 1944 (Dec. 31, 1937; March 21, 1940). G.M.H.

Rutile titanium dioxide pigment preparation. S. S. COLE AND W. K. NELSON (Canadian Titanium Pigments, Ltd.). Can. 418,858, March 7, 1944 (Dec. 31, 1937). G.M.H.

Titanium dioxide brilliance and color improving method. R. H. MONK (American Zinc, Lead & Smelting Co.). Can. 419,279, March 28, 1944 (Oct. 19, 1940; in U. S. Dec. 4, 1939). G.M.H.

Titanium dioxide pigment preparation. JELKS BARKSDALE AND W. W. PLECHNER (Canadian Titanium Pigments, Ltd.). Can. 418,862, March 7, 1944 (May 16, 1941). G.M.H.

Titanium oxide pigment production. R. K. WHITTEN (Canadian Industries, Ltd.). Can. 418,853, March 7, 1944 (Nov. 23, 1939). R. M. MCKINNEY AND H. M. STARK (Canadian Industries, Ltd). Can. 418,854, March 7, 1944 (Jan. 3, 1940). J. H. PETERSON (Canadian Industries, Ltd.). Can. 418,856, March 7, 1944 (Oct. 7, 1940). G.M.H.

Titanium pigment production. J. E. BOOGE (Canadian Industries, Ltd.). Can. 418,852, March 7, 1944 (June 13, 1939). G.M.H.

General

Action of finely divided magnesium upon the lungs. LEROY U. GARDNER AND ANTHONY B. DELAHANT. *Amer. Jour. Pub. Health*, **33**, 153–56 (Feb., 1943).—Small particles of metallic magnesium embedded in living tissues dissolve with evolution of hydrogen and the production of an irritating alkaline hydroxide. When all the metal has dissolved, the inflammation subsides and healing ensues. The quantity of metallic irritant used determines the severity of the injury, the amount of residual scar tissue being proportional to the severity. Such observations developed the suspicion that dust created in manufacturing and machining Mg and Mg alloys might injure the lungs, but such hazard could hardly exist under the present conditions of manufacturing powdered Mg because the danger of fire and explosion precludes the exposure of workmen to any appreciable atmospheric concentration of this mineral. In the processing of the metals little fine dust is produced, and results obtained in subcutaneous tissue could hardly be duplicated in the lungs. The finest dust would theoretically dissolve on contact with water vapor in the nose, trachea, and large bronchi, liberating hydrogen at points where it could be readily exhaled. The authors tested the validity of this reasoning by a series of animal experiments. Actual inhalation of Mg as dry dust was not feasible due to the dangers of explosion. The same result was secured by the introduction of salt-solution suspensions of fine Mg particles through a tracheal tube. The procedure with guinea pigs

and cats is detailed and results are discussed. Finely divided Mg does not affect the lungs as it does subcutaneous tissue, and "gaseous tumor" is not formed, due to the free communication of pulmonary air spaces with the external air. Even though manufacturing processes permitted inhalation of an appreciable amount of magnesium dust, it is highly improbable that serious injury of the lungs would ensue. 3 references. K.R.

Agamatic pioneers in manufacture of first ceramic cooking range. J. W. JACKSON. *Ceram. Ind.*, **41** [6] 75–76 (1943).—The Agamatic Range Corp., Summit, N. C., has developed an all-ceramic cooking range. Illustrated. H.T.

Aspects of mine dust suppression. W. STATON. *Science & Art of Mining*, **53**, 253–54, 271–72, 278–79, 290–91 (1943).—To keep the coal as large as possible and to keep dust out of the air, coal-cutter picks must be kept sharp, the use of explosives should be reduced or eliminated, and the coal should be wet during loading and hauling. Air-cleaning installations require the consideration of many factors. Dust at the loading points should be caught before it is dispersed; in roadways a mist projector may be used, or brattice cloth may be put across the roadway and kept moist by sprays. Drilling in rock should be done wet or with the use of a dust trap. A rotary rock drill keeps the production of fine dust to a minimum. Dust should be reduced after blasting by a mist projector. Gravimetric samples are taken with a filter tube. The thermal precipitator is recommended rather than the konimeter. W.D.F.

Birmingham detinning plant now operating. ANON. *Mfrs. Record*, **113** [4] 45, 66 (1944).—One of the country's largest detinning plants is now operating at Birmingham, Ala. It has a capacity of 20,000 long tons per year and is able to detin about 300 million No. 2 tin cans annually. Process operations are described briefly. 4 photographs. M.R.

Cement industry outlines plans for continued battle against accidents. A. J. R. CURTIS. *Pit & Quarry*, **36** [10] 91–92 (1944).—The Portland Cement Assn. Committee on Accident Prevention and Insurance reported that the number of accidents since Jan. 1, 1943, had fallen off 10% from the 1942 figures. Production was off about 25%, so the net showing may be unfavorable. C. discusses the many steps being taken to reduce accidents. It is planned to hold 15 regional safety conferences during the early part of 1944. 3 photographs. M.R.

Ceramic education and training in Japan. V. G. N. PANICKER. *Claycraft*, **17** [6] 316–18 (1944).—P. describes the following types of ceramic schools in Japan: (1) Ceramic schools of the secondary standard. There are three schools, at Seto, Yokkaichi, and Tokonabe, where the fundamental ideas of clayware manufacture and training in its art are taught along with the usual secondary education. (2) College of Technology, which maintains a ceramic department. A 3-year course covers the art and science of all the ceramic industries, pottery, glass, porcelain, refractories, etc. (3) The University of Engineering, which has a 3-year course in ceramics leading to a M.Sc. standard. The department maintains well-equipped research laboratories and publishes many advanced papers each year. There are seven ceramic experiment stations. Raw materials are analyzed for industry, processes are evolved, and various problems are studied, e.g., bone china, crystal glaze, firing with sawdust, etc. G.A.K.

Ceramic Educational Council—Report of Committee on Extension and Postwar Rehabilitation. E. P. MCNAMARA, *Chairman. Bull. Amer. Ceram. Soc.*, **23** [5] 164–65 (1944).

Ceramic and industrial minerals in the war effort. H. G. FISK. *Jour. Chem. Education*, **19** [11] 510–12 (1942).—Recent developments in the fields of glass, porcelain, enamels, abrasives, cement, and refractories are discussed briefly with emphasis on their contribution to the war effort and the needs of the armed forces. S.Z.

Damaging effects of fly ash on industrial equipment and processes. T. W. REYNOLDS. *Heating & Ventilating*, **41** [4] 53 (1944).—R. discusses the fly-ash problem generally, with specific mention of a few pieces of industrial equipment seriously damaged by the ash. M.R.

Developments in the treatment of water. ESKEL NORDELL. *Paper Trade Jour.*, **115** [15] 23–27 (1942).—The Spaulding precipitator may be used to soften water, to remove silica by the use of dolomitic lime, and to remove turbidity or color, tastes, and odors. Use of the Spiractor, rotary surface washer, and zeolites for water softening is discussed, as well as demineralization procedures (*Ceram. Abs.*, **23** [2] 46 (1944)). Flow diagrams are presented. W.R.B.

Dirty aprons and floor dust as silicosis hazards. MALVERN REUTER. *Ceram. Ind.*, **42** [2] 54–57 (1944).—A dust-control program at the Buffalo Pottery improves hygienic conditions by inexpensive means. Illustrated. H.T.

Fifty years of ceramic education marks growth of industry. ANON. *Ceram. Ind.*, **42** [4] 39–49 (1944).—The growth of ceramic education in the U. S. is discussed, and a detailed description is given of present-day working programs of 16 ceramic departments at schools and universities. Illustrated. H.T.

Heat insulation in industrial establishments. R. C. PARLETT. *Paper Trade Jour.*, **114** [23] 27–38 (1942).—P. gives a comprehensive discussion of the theory and practical aspects of heat insulation in industrial plants. Abundant data are presented to prove the economy of insulation. Factors to be considered in the selection of insulation are discussed in detail. W.R.B.

Making belts last longer. S. JONES. *Pit & Quarry*, **36** [10] 73–79 (1944).—The art of making belts last longer consists of meticulous attention to a great number of details, none of which can be safely neglected, yet comparatively few of which are of outstanding importance. Belt troubles are seldom attributed to the belts themselves. With a properly selected belt, most troubles can be traced to the supports or mechanism. Belt failures and belt care are discussed under the following headings: pulleys; tightness and tightening; slippage and creep; loads and overloads; belt stretch and belt strength; belt joints, dressings, and repairs; belt flat drive; V-type belts and conveyer belts. 8 diagrams, 1 photograph. M.R.

Manpower problems, postwar preparations occupy OCIA meeting. ANON. *Ceram. Ind.*, **41** [5] 60–64 (1943).—Abstracts of papers read at the annual meeting of the Ohio Ceramic Industries Assn., Oct., 1943, are given. The chief topics are discussed. H.T.

Operation and maintenance of steam boilers. F. J. REDMAN AND H. A. J. MCDONIC. Presented at meeting of South African Institution of Engineers; abstracted in *Mech. World & Eng. Record*, **113** [2961] 382–85 (1943).—Details of experience with some South African plants are given. The furnace arches are modified in such a way that the area of the air ports near the side walls is twice as great as that at the center of the arch, to obtain abundant air distribution. Grit liberation and its effect and fan erosion are described in detail. P.G.

Palmetto Quarries' modern plant operating well over rated capacity. W. E. TRAUFFER. *Pit & Quarry*, **36** [10] 87–90, 92 (1944).—T. describes the operating features of the recently built plant of the Palmetto Quarries Co. at Columbia, S. C. A capacity of 225 tons per hr. of crushed granite has been achieved. 17 photographs. M.R.

Pneumoconiosis of coal workers. Ninth report of the Coal Dust Research Committee of the Monmouthshire and South Wales Coal Owners Assn. *Colliery Guardian*, **167**, 267–70, 293–97 (1943). W.D.F.

Reduction of dust at the coal face. D. JONES. *Colliery Guardian*, **166** [2] 213–18 (Feb. 19, 1943); abstracted in *Jour. Ind. Hyg. & Toxicol.*, **25**, 162 (Sept., 1943).—Experiments carried out by Amalgamated Anthracite Collieries to reduce air-borne dust at the coal face, with the hope of diminishing the pneumoconiosis hazard among the anthracite miners of South Wales, are described. The dustiest operations are the getting and the subsequent loading (or filling) of the coal. The principal source of respirable dust at the coal face is along well-developed

cleavage planes in anthracite seams. When the coal is worked, less dust is dispersed where water seeps through the strata. It was decided to try producing such a condition artificially. Boreholes were driven 15 ft. into the coal, and water mains were connected with these for several hours. Water pressures up to 300 lb. per sq. in. were used. Konimeter measurements of dust concentrations were made under "dry" conditions and then under water treatment. Dust observations were made when the only work being done was the getting and filling of coal. "Dry" observations gave an average count of 38.9 million particles per cu. ft. Driving the boreholes 15 yd. apart gave an average dust count after water treatment of 13.6 million particles per cu. ft.; when the boreholes were only 10 yd. apart, the average dust count was 10 million particles. K.R.

Rope-ology. E. L. CADY. *Mech. Handling & Conveying*, **30** [10] 429–33, 445; [11] 495–96 (1943).—The importance of rope in materials handling is pointed out. As hemp from the Philippines and sisal from the Dutch East Indies are no longer available and African sisal is scarce, jute is now being investigated as a possiblity for rope making. C. describes rope making and gives physical data pertaining to rope, a comparison of sisal and manila ropes, some facts on the use and handling of rope, and types of damage to rope. Suggestions are given for increasing the life of ropes. 1 photograph, 2 diagrams. M.R.

Simple truth—industry's weapon against socialistic crackpots. ENDERS M. VOORHEES. Presented before Controllers Inst. of America; abstracted in *Ceram. Ind.*, **41** [6] 38–40 (1943). H.T.

Urges proper care of rock drills as definite contribution to war effort. E. C. POWERS. *Pit & Quarry*, **36** [10] 71–72 (1944).—P. discusses rock drills, their work, and their maintenance and repair. Included are suggestions for proper lubrication, the forging and sharpening of drill bits, and the control of air pressures. Inspections at frequent and regular intervals are recommended. 6 photographs. M.R.

Water-treatment developments. WILLIAM R. GIBSON. *Paper Trade Jour.*, **114** [20] 53–56 (1942).—G. discusses the various forms of water treatment available, particularly the latest developments, dealing first with the standard treatments and then pointing out the more important improvements and modifications made in recent years. The improvement of water from the viewpoint of the pulp and paper manufacturer, by the addition of wetting agents, dispersives, and other chemicals, is dealt with. W.R.B.

SEPARATE PUBLICATIONS

Summary of State laws pertaining to explosives: I, District B, Conn., Del., Maine, Mass., N. H., N. J., N. Y., R. I., Vt. Compiled by BERNARD M. NEWBURG WITH BERNARD H. LEVINSON AND CHARLOTTE T. LLOYD. *U. S. Bur. Mines Information Circ.*, No. 7251, 118 pp. Free. **II, Districts A and C, Ky., Md., Pa., Va., W. Va.** *Ibid.*, No. 7252, 73 pp. **III, Districts E and F, Ill., Ind., Iowa, Mich., Minn., Mo., Neb., N. Dak., S. Dak., Wis.** *Ibid.*, No. 7253, 91 pp. **IV, Districts D and G, Ala., Ark., Fla., Ga., Kans., La., Miss., N. C., Okla., S. C., Tenn., Texas.** *Ibid.*, No. 7254, 75 pp. **V, District H, Ariz., Calif., Colo., Idaho, Mont., Nev., N. Mex., Oreg., Utah, Wash., Wyo.** *Ibid.*, No. 7255, 106 pp. R.A.H.

THE SECOND MILE

A Re-survey

By

William E. Wickenden

President, Case School of Applied Science

"Whosoever shall compel thee to go one mile—go with him twain." You will recognize this text from the Sermon on the Mount as a counsel of perfection, good advice in the form of a paradox which emphasizes a profound truth by an apparent denial of common sense. Every calling has its mile of compulsion, its round of tasks and duties, its code of man-to-man relations, which one must traverse day by day if he is to survive. Beyond that lies the mile of voluntary effort, where men strive for special excellence, seek self-expression more than material gain, and give that unrequited margin of service to the common good which alone can invest work with a wide and enduring significance. The best fun of life and most of its durable satisfactions lie in this second mile, and it is only here that a calling can attain to the dignity and distinction of a profession.

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THE BULLETIN SECTION

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HENRY EWERTZ

CERAMICS FOR THE CRIPPLE CHILD

By Henry Ewertz*

The art of pottery-making has served mankind in thousands of ways for centuries. As a functional art, it served him well, making life easier and richer. Culturally, it gave him a great vehicle for a wide range of artistic expression. It also rewarded the artist craftsman himself by enriching his life with a varied, all-absorbing, fascinating profession. But there is still another aspect in which ceramics can serve society, that is, the therapeutic aspect. In the Widener Memorial School for Cripple Children in Philadelphia, ceramic work is invaluable in bringing about the mental and physical rehabilitation of the cripple child.

"A sound mind behind a crippled body becomes a crippled mind, unless adequate channels of expression are provided," states an eminent neurologist. These children often have been compensated by nature with gifted minds, keener observation, and a more fertile imagination. All these are stifled by inner conflicts and a feeling of inferiority due to their deformities. We try, in ceramics, to break down these impediments by creating a sense of accomplishment and importance, thereby opening up a road to the joys of artistic expression, self-reliance, and a more wholesome psychological adjustment.

Our effort, therefore, at the Widener Memorial School, is directed first toward a wholehearted, enthusiastic, and all-absorbing interest in clay, glazing, and kiln-firing. This work is particularly adaptable to the cripple child. Clay itself is soothing and relaxing. A success experience is felt from the first thumb squeeze and is repeated as the work progresses, thereby retaining a continuity of interest. The making and application of glazes teach color combinations and some chemistry. The firing of the kiln is always an exciting adventure and a great teacher. The fire rewards the diligent worker with a more durable and beautiful piece. It reprimands the sloppy worker with an ugly object or a handful of broken clay. And yet the latter does not happen often enough to be discouraging,

Display of work of the cripple children

but rather acts as an incentive for more conscientious workmanship. When a well-made piece goes through the fire successfully, the student feels the happy thrill of professional accomplishment. The work is then taken home and admired by parents and friends. This gives the crippled child a feeling of mastery which helps immeasurably to compensate for his deformity.

The handicapped child who has normal hands and a

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sound mind can, and often does, show ability and interest in the entire ceramic process. But there are those who, because of disease, accident, or birth, cannot enter into all of these phases. There is the bright child with a paralytic arm or legs, the spastic victim with bad coordination, the mentally dull child. The ceramic field is so large and varied that almost all of these can find some ability, some talent, some interest that they can apply to this work. An applied skill or interest not only helps them physically but psychologically as well by giving a feeling of being able to really do something. Whatever muscle or member that is left unimpaired often has been, or can be, developed to a high degree. A child with one arm shows great resourcefulness in doing sculptures in the lap, using the thighs to support the opposing hand. In this case, the handicap often helps the child to make better sculpture inasmuch as it will be devoid of detail and will be simple, direct, and strong, which, after all, is the essence of good sculpture. The spastic child whose trembling, noncoordinated hands seem useless in clay work can gain therapeutic benefits in this medium. The results are often apparent and hopeful. The powerful arms of the cripple whose legs were made useless by paralysis can do fine work on the electric potter's wheel, as well as modeling. The child in a wheel chair can do underglaze painting on dishes or tile. Then, too, we occasionally have the dull child of low mentality. Kindness and understanding will ferret out his potential ability or interest, then apply it to some phase of ceramics and develop it as far as possible. The making of simple molds, pressing, slip mixing, and clay wedging may be tried, all necessary tasks in a potter's studio. No matter how lowly the job, he who does it well becomes important, not only to ceramics, but to himself.

Stacking the kiln

We are working not only for a happier psychological adjustment through clay work, but are trying to teach the craft with the hope of economic independence. For instance, the gifted can open a studio in the cellar or spare room. With an electric kiln, clay, and glazes a beginning can be made. For those, the gift shops, dealing in handmade ware, are a potential market. Also original models may be offered for sale to large potteries for mass production and distribution. For the manually inclined, various skills used in ceramic work are developed which also can be of value to the commercial field. Every student is watched for a definite aptitude or skill and encouraged to develop it to a high degree.

(1944)

The results of ceramic work on a normal mind which has become warped and discouraged because of a physical handicap are often dramatic and gratifying. A girl who is badly deformed became a problem child in the school. She was morose, embittered, and known as a queer, unpredictable child. She was sent to the pottery class and here she found herself. A special aptitude for modeling was discovered which gave her a new outlook, made her more cheerful and at times enthusiastic. She worked quietly and diligently. Her total absorption indicated

Glazing the St. Francis tile for the bird-feeding shelter

that she was enjoying peace and quiet happiness. As she gained self-assurance, she attempted problems that seemed almost beyond the physical ability of her crippled hands. Within a few months she made several ceramic figures, a beautifully incised plate, a thirty-inch-high terra-cotta garden figure, vases, and costume pins. She was taught mold-making and commercial reproduction processes with the hope that she would ultimately enter the gift-shop field. The ceramic pins were her first source of income from faculty and friends at Christmas time. This was a new thrill experience for her. After much urging, she agreed to offer her products to the nearest gift shop. It was her biggest battle, for, being deformed, she shrank from public gaze. The progressive confidence she gained through her work in clay gave her the courage, however, to enter the shop. She was rewarded by the sale of all she offered. A suspicion entered her mind that the purchase was made just out of pity. That was dispelled, however, when, after a few weeks, the owner called her and said that he had sold all and wished more of her things. She found herself in this work and, if she persists, will enjoy a happier and more useful life.

Another student in the class is very spastic and is confined in a wheel chair. His hands tremble badly, but he has a fine mind and extraordinary patience and determination. At first he spilled, dropped, and fumbled everything and seemed to be getting nowhere. But he had

a great desire to make something and have it fired. Little by little we noticed improvement in the control of his hands. His crowning achievement was when he completed a jewelry box for his mother. To the outsider it seemed a mean thing, so crude and crooked, and the glaze he applied was very uneven, but to him it represented all his own creation. It was an enormous problem and a great victory for him.

Clayworking cripple fingers

Health and happiness in creating

Then there is a backward boy in the class. Classroom work was too much for him, and he was considered to be dull. In the ceramic class, however, he was "tops." His talent was obvious, and he could apply himself to the work with interest and success. Among other things he made a charming sundial in glazed terra cotta, adorned with a boy riding on a snail. The quotation he chose for it is, "It's later than you think." The boys mounted it in the school garden, and the children enjoy reading the sun's time.

A decorative bird-feeding station is in the making. This shelter is comprised of a low-relief plaque of St. Francis, glazed and fired to a high temperature. The birds will be protected by a roof of handmade tile. This bird sanctuary, too, will be mounted on the school grounds.

These ambitious problems encourage continuity of interest. Cripple children work harder and with more pleasure when solving a big problem. The fact that it is enduring and useful helps much to make the completion worth while. It also gives them an opportunity to show their loyalty and appreciation to the school which helped them help themselves.

The ceramic work of the Widener Memorial School is carried on with a large Globar electric kiln and a gas kiln. The ceramic class has the support of Earl Milliette, Director of Fine and Industrial Arts, the medical staff, and the parents. The electric kiln was the gift of the parents of these handicapped children. The work progresses rapidly in importance in this school through the aid of Dr. Alexander Stoddard, who realized the value of ceramics and assigned me to establish this Department, and through the vision and energy of Dr. Georgianna Mendenhal, the principal of the School.

THE UNIQUE CONTRIBUTION OF CERAMICS TO CHILDHOOD EDUCATION *

By Martha M. Sherman

Abstract

With clay as a medium of expression, a primary class developed desirable creative attitudes in learning. Clay is peculiarly well suited to the job. Mastery of skill is necessary only insofar as it helps support the development of individual capacity to see, feel, and think.

I. Introduction

The teacher's task is a creative one. The educator knows that he must stimulate, awaken, or create an interest among the pupils assembled about him. The day is past when proper pedagogical procedure permitted the teacher to stand in front of his pupils and attempt to transfer knowledge to them much as slip is poured from one container to another. Today we acknowledge that the learning process in the classroom is most effective when teacher and pupil share creative experiences. This does not mean that the teacher lacks familiarity with the subject or materials as do his pupils but rather that he is continually seeking new and more effective ways to stimulate original-

* Presented at the Forty-Fifth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 21, 1943 (Art Division). Received April 22, 1943.

ity and thinking among his charges. The teacher knows that through coordination of mind, hand, and emotions, creative activity offers a great educational force. His ability to present and use materials that lend themselves well to such coordination will help mark the educational growth in his classroom.

II. Manipulatory Period

Clay presents itself as a most desirable medium for creative expression. With only a few exceptions, children love the feel of clay. Because of its definite bearing on normal growth, this first stage in child development has been called the manipulative stage. During this period the material is of paramount interest to the child. What the material will do when he pinches it, rolls it, twists it, and scratches it is more interesting than is shaping it into a form. The feel of the clay, the plastic character of the stuff, is fascinating.

Coupled with the manipulative possibilities of clay, the teacher will recall the physical requirements of a material considered ideal for learning processes, namely, (1) no muscle or eye strain, (2) no hazard to health or safety, and (3) allowance for individual differences, thinking, and inventiveness. Clay readily meets these requirements. Forearm muscles and the larger ones of the hand are developed first. This development is desirable for later skill training; muscular coordination cannot be minimized. The classroom situation that permits tiny pencil sketches made within the radius of a tightly clutched hand has not only been detrimental to artistic growth but has harmfully retarded muscular coordination.

Many materials used in the classroom have presented definite limitations; paper, paints, pencils, and crayons are limited for the most part to two-dimensional renditions, whereas concepts of things about us are three-dimensional in character. Johnny's drawing may be remarkable; his composition may be uncannily artistic from the standpoint of design, color, and draftsmanship; but Johnny himself is dissatisfied with the lack of weight, shape, and bulk of his objects. His awareness of form occupying space will find satisfaction with a material such as clay.

III. Creative Period

As soon as the child has progressed through the manipulative stage and finds his fingers do what he wants them to do, he will attempt to fashion something to satisfy his creative impulse. It may have little meaning to an adult and little more to his classmates, but it symbolizes his idea. It is at this stage that a teacher familiar with children's work and with ability to judge from a point of view other than adult standards can encourage creative expression. In this symbolic stage, imagination and individuality of expression need no longer remain dormant. Children know and feel gaiety, solitude, conflict, and peace. They will express any of these when encouraged. Lumps and ropes of clay piled and twisted together may rival the abstractionist's sense of design. They may express monumental calm and repose or the turbulency and rebellious character of an Orozco mural. Mary's symbolic cow, closer to representation though not anatomically correct, may express contentment or ferocity. Whatever the form may be, the individual interpretation is there. The teacher who recognizes and encourages expression in these masses, or messes, as some would be prone to call them, can go far toward developing a class of thinking and feeling individualists.

The symbolic stage is usually quickly supplemented by one of more exact representation. From now on for the rest of his school years the pupil will be seeking continually for more perfection in representation. Constant vigilance on the part of the teacher is necessary to provide stimulating surroundings at all times. The child's mind, therefore, will be so dominated by his experiences that he will demand an outlet in some form of creative release. Mimicry is less apparent when the desire for expression is strong.

IV. Mastery of Skill

Little emphasis is placed on skill in the primary grades. Help and instructions for handling clay need be offered only when the lack of skill will hamper expression. Methods of sealing cracks, use of slip, and other skills will come with the demands of construction. Methods of building forms in clay can be introduced to solve problems of structure. If standards are kept high because the demands of teacher and class emphasize objects with character, skill and ease of manipulation follow along with the continual quest for individual expression.

The primary teacher presenting clay to the class for the first time will be satisfied if only a few choice objects are forthcoming. In the next lesson, however, she will expect the random pinching, pounding, and wadding of clay to last only a short time. Clay forms with meanings will be developing. Mary's cow, ferocious in her mass and stance, may receive some choice bits of embellishment to make her more terrifying. With twisted strings of clay or incised lines, Mary adds that bit of detail which makes her interpretation more positive. Discriminating choice of detail will have been the result of artistic guidance and discussion from the class.

After a succession of lessons, worth-while things may be expected from everyone in the class. These clay objects can then be fired for permanency and glazed for decorative value. Children have an astounding decorative sense and, when allowed to use several colors of slip or glazes, will give tone value to their pieces.

With firing and glazing processes, new fields of interest are opened for investigation. Associations with elementary principles of science, a working knowledge of application of art principles, and a glow of appreciation of familiar objects that previously had gone unheeded are all educational results.

Pupils' excitement and enthusiasm over their clay experiences have been recorded by Natalie Cole.[1] One little tot has expressed herself in an individual way. About the objects that had been fired, she says, "When the teacher brought back the clay things, I was so anxious I just couldn't sit still. I felt some ants crawling about me, bees stinging me, and I was all jump."

V. Conclusion

The clay medium can be an art experience that is vital to education. It is concerned with developing the individual capacity to see, to feel, and to think. Mastery

[1] Natalie R. Cole, The Arts in the Classroom, p. 43. John Day Co., Inc., New York, 1940.

of skill and techniques are necessary only as they help support or carry out these objectives.[2] What the creative experience does for the individual himself is the matter for emphasis. Secondary things, such as development of better taste and discriminating judgment, are important gains encountered through participation. The most significant result is that creative participation has contributed to learning or education.

[2] Pauline Johnson, "The Future for Art in Public Education," *College of Education Record*, **9**, 33–35 (Jan., 1943).

TEACHERS COLLEGE
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EDITORIAL
FUTURE OF THE STRUCTURAL CLAY PRODUCTS INDUSTRY*

BY L. R. WHITAKER

In this oration, I have not come to give you an obituary of the brick and tile industry, but to take my cue from the oration of Mark Antony, when he said over Caesar's body: "Friends, Romans, and Countrymen, I have not come to bury Caesar, but to collect his life insurance."

The life of the brick industry for a long period was carried on in the realms of mysticism: mysterious secrets were the technology of a previous day, and processes were carried in the form of masked tradition.

This was not only true of the brick industry, but of all industries in a former era.

During the past two generations, the National Brick Manufacturers' Association, *Brick & Clay Record*, and The American Ceramic Society have made a compilation of ideas that now gives us an insight of facts that ameliorate our problems.

It is an insult to those who have spent years in the brick industry for some persons or organizations to state that the brick and tile industry is decadent, is incompetent, is going broke, cannot liquidate its investments, and should be regimented.

To these arguments, I wish to make an answer.

The brick and tile industry is no different from other industries. There are failures and successes in all forms of commercial activities.

The brick industry is not hopelessly decadent. It does not have the technological development that a few industries have, yet it has been able to survive.

Many plants are studying the preparation of clays, forming the ware, drying, firing, and mechanical handling.

Those plants which are making the best use of the knowledge available are not broke, nor are they going insolvent.

A great many plants are making use of new processing. Too many are languishing idly by, trying to find a magical process of law that will act as a Moses to lead them out of insolvency. Too many are looking for a fanciful process to solve all of their problems, whereas others, by the process of hard work and sound thinking, are progressively lowering costs and producing better ware.

All industries must work out their problems one at a time. Can you expect a firm to solve its financial encumbrance with a $50,000 loan, when its present facilities are not operated efficiently?

There are brick and tile plants that are decadent, and there are others that are progressive.

There are plant operators who are incompetent; there are others whose bank balances prove their skillful management.

There are plants which in a former era made money. This money has been spent for other things than the proper care, maintenance, and improvement of the plant.

A man's interest in his plant will be in proportion to the amount of his earnings he will spend on improving it.

A few years ago, a representative visited an organization of brick plants and told them that they were all going broke and that he had the power to save them.

One plant in this sectional organization had just the week previous divided $65,000 to the stockholders on an investment of $200,000.

Last year, a brick-plant operator, irritated by the forms to fill out for Washington and the fear of jail, said: "I have $100,000 in cash, my boy is in the Army, and I'm behind in my fishing." This man is a pioneer in face brick; he knows every part of his plant, he can operate every machine, he has worked hard.

Another plant operator started with a pile of junk ten years ago. He now has a plant worth $250,000, and it is up to date and paid for. This man talks brick, thinks brick, and works hard.

In a town which is supposed to be a brickyard cemetery, there are three relatives who operate two plants. The oldest man was graduated from college, went into the plant, and became eventually the operating head. A brother finished school, and in time the first man moved up. The third came along and the second was advanced. These three men study their business, try new ideas, and employ two ceramic engineers. They produce high-quality ware. While other plants around them became insolvent, they retained their leadership and remained highly solvent.

Several years ago, a man with little capital borrowed $30,000 from the RFC. His son, a mechanical engineer, worked hard with his father to master the business. Because of their lack of experience, they were forced to borrow another $30,000. They have now paid up the $60,000 loan and are making a nice profit. The first $30,000 might be called the price of their education.

At another plant, which is highly successful, the owner went in debt for $100,000 before he made money. He would not be licked, even though his education cost $100,000.

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 5, 1944 (Structural Clay Products Division). Received April 22, 1944.

Another clay plant pays its stockholders 25% interest on their money; for fear of Uncle Sam, it does not pay more.

You will note that I have stressed two things: first, these instances are written not of a former era, but deal with the present. Second, the solutions have all been given in terms of hard work and sound thinking.

Churchill promised England blood, sweat, and tears. There is no need of blood and tears in our industry unless we relegate ourselves to self pity. The secret of the brick industry is sweat and labor.

The aspects of our industry are changing. They are not revolutionary, neither are they beyond our control.

All of these revolutionary ideas to capture our building market are fanciful theories that claim they are going to crowd the brick and tile industry out of the picture.

The plastic and substitute materials have a strong point of argument until we investigate their costs. They look wonderful in a full-tone rotogravure lithograph picture with an artful background. But in actual life they give the appearance of a glorified packing crate or an oversized edition of Chic Sales' "Specialist."

We have a basic building product. Most of the substitutes must be nailed on something else.

Our industry has some problems, the first of which concerns production:

(1) Plants with cumbersome, out-of-date equipment where the manufacturing costs are high, instead of planning their expansion, have placed machinery and added buildings without regard to any formulated design.

(2) Many plants are trying to include returns on antiquated and abandoned equipment.

(3) Plants producing junk have been allowed to stay in business because the better plants have not progressed to the point where their products have made a clear differential between the good and the bad. The better plants sell junk at times to clear their inventory.

(4) A main factor for discussion is that of uniform quality and size. These are vulnerable points where our competitors are able to assail us. Constant size and constant quality are two of our main problems. To control these factors all phases of manufacturing must be controlled.

We have been offered the Modular System. Yet no Modular System is possible unless the variation in size is considered. The Modular System has been offered as a promotional idea, when in reality it is a manufacturing problem.

We have a great deal of work to do on the control of sizing, which must start at the clay pit and extend through the entire manufacturing process. Next year we should have an extended discussion on factors and remedies for the closer control of sizing.

We must have a research program, some of which must be technical. From technical research, we have derived deairing and a better understanding of dies, chemical treatment of clays, and other phases which began as pure research and are now an integral part of our production.

They all began in sessions of The American Ceramic Society.

For practical research, we must have an exchange of ideas in the Structural Clay Products Division.

One of our sins is egotism, as too many of our operators think that their individual brains can bring forth a complete solution of their problems.

Too many of us, as God-fearing men, are ready with our time and means to give liberally to the church, help a destitute, contribute to foreign savages, help anyone in need, but if he happens to be in the brick industry, we hope he starves.

Our individual plans are to furnish an all-clay-products five-room house with bath for less than $1500. Then let the substitute man try to beat it. In fact, it is being done.

Our future is bright. The war houses will soon return to dust. A permanent clay-products home will return men to a life of stability.

Perishable lumber is scarce and high. We have no competition except our failure to grasp an opportunity.

CAROLINA CERAMICS, INCORPORATED
COLUMBIA, SOUTH CAROLINA

REPORT OF COMMITTEE ON RESEARCH

A considerable amount of ceramic research has been concerned with problems of vital interest to war production. New applications for various ceramics are noted as also the use of new materials in these ceramics. Basic research has suffered increasingly owing to the lack of a sufficient number of trained personnel in the various research laboratories, and this situation without question will become more critical during the current year. Some research projects cannot be referred to for reasons of security.

Enamel

The principal theories of enamel adherence have been reviewed, and the theory involving hydrogen gas has been discussed. According to this theory, porcelain enamel requires no intermediate layer at the interface to promote adherence to iron, and, were it not for the presence of hydrogen in the base metal, enamel would adhere as readily to iron as to copper, gold, or silver.

The solubility of iron oxide in ground-coat enamel glasses at various temperatures was studied by adding varying amounts of ferric oxide to the milled enamel and giving the mixture a heat-treatment to acquire uniformity without devitrification at the desired temperature (15).* The temperature coefficient of solubility was quite great and probably plays an important role in the formation of copperheads. The solubility of ferric oxide in enamel glasses was not appreciably affected by changes in the composition. There was an apparent trend, however, toward the following effects: An increase in soda tended to increase the solubility slightly. A decrease in alumina tended to increase solubility to a pronounced degree. An increase in silica also increased solubility. High boric oxide enamels tended to have slightly lower solubility than those with low boric oxide content. An increase in cobalt oxide decreased solubility slightly, whereas an increase in nickel oxide decreased solubility to a lesser degree. Barium oxide additions increased the solubility of ferric oxide to an appreciable degree.

The effects of substituting lithia for soda in a white cover frit has been observed. The substitution of lithia for soda on a mol basis resulted in improved fusibility,

* Numbers in parentheses refer to references given at the end of this report (see p. 203).

gloss, and opacity; higher gouge resistance, surface abrasion, and acid resistances; and a lower thermal-expansion coefficient. When lithia was used to replace soda on a weight basis, the enamels showed increased fusibility; a small increase in gloss; a small decrease in surface abrasion resistance; marked decreases in opacity, gouge resistance, and acid resistance; and little change in thermal-expansion coefficient; there was, however, a noticeable lowering of the transformation temperature. From the relative fluidity curves, it was deduced that one part by weight of lithia is approximately equivalent to 2.3 parts of soda.

A fundamental study has been made of factors influencing the color of porcelain enamels (15). The basis of color specification, viz., brilliance, purity, and dominant wave length, was determined from spectrophotometric curves by means of an integrating calculator. The effect of variations in the particle size of typical green and blue color stains in size fractions of a representative clear frit was studied with respect to the fundamental color properties. With a constant frit particle and a variable-sized color particle, the brilliance decreased to the < 5-micron fraction and then increased. The dominant wave length showed no appreciable change. With a variable-sized frit particle and a constant color particle, the brilliance increased and the color purity lessened as the frit particle size was decreased from 45 to 75 microns down to <5 microns.

The study of the properties and the film strength of enamel slips has been retarded by the lack of information concerning the possible presence of electrolytes in enamel mill liquors and their relation. A summary has been made (15) of the present basic information concerning the individual chemical, physical, and pyrochemical characteristics of the possible, more common soluble constituents present in porcelain enamel slips. The data were chosen with particular regard to their importance in the study of the nature and effect of the various soluble salts on the properties of enamel slips and on their drying behavior. Observations of the results of this study led to the following conclusions: Enamel tearing is a defect caused by shrinkage stresses set up in an enamel film during drying and early firing combined with the inability of the film to absorb these stresses properly. The capacity of a nontearing enamel to resist tearing depends on the absence of a strain gradient during drying as well as on a loose, weak texture. The packing character of the enamel during drying affects the characteristic shrinkage and resultant strain gradient in a tearing enamel. This packing character is determined primarily by the state of aggregation of the enamel slip according to the kind and quantity of adsorbed ions present. The ion most effective in enamel slips is the Na^+ ion freed on solution of frit glass. The final state of aggregation of a dry enamel is influenced in extreme cases by the total quantity, disposition, and crystalline characteristics of the soluble salts present. The addition of boric acid to an enamel slip causes tearing by forming a buffer salt (probably borax) that disperses the slip and permits it to pack so that strain and tearing result. Sodium nitrite and a number of other salts prevent tearing by repressing the buffer and balancing the Na^+ ion concentration to give the enamel the proper packing characteristics.

The weather resistance of porcelain enamels has been one of the most difficult problems of the enameler. A recent study was reported where experiments were conducted using the accelerated weather test developed at the National Bureau of Standards. Heavy spalling often appeared to involve large bubbles or close clusters of small bubbles. When a few bubbles appeared, the spalling often followed a bubble pattern. When scumming or shorelining defects occurred, the spalling appeared to follow the pattern of these defects. The accelerated test should give a basis for prediction of the general behavior under actual weathering conditions. In its present state of development, however, this test does not permit a prediction of the degree of weather resistance of various porcelain enamels.

An investigation was undertaken to determine the relation of thickness to the impact resistance of porcelain enamels. The impact resistance of enamels over a radius increases as the thickness of the enamel increases. The chips of enamel that are removed from thick coatings are larger than those removed from thin coatings when the failure is caused by impact over a curved surface. A correlation was found between the results secured with the P.E.I. test and those on rigid curved surfaces.

Research is under way on the enameling of wire-wound resistors (21 and various commercial laboratories). Enameled resistors of present-day manufacture fail to pass rigid service tests. This has been considered to be due to the inability of the enamel coating to withstand the severe thermal shock to which resistors are subjected in the tests. The failure is characterized by crazing, peeling, or chipping of the enamel, thus opening the surface and permitting the penetration of moisture by which, through electrolytic action, the wire is corroded to the extent that the unit ultimately fails electrically. The object of this work is to produce enamel-covered resistors which will withstand severe thermal changes and high humidity in service.

Other researches on enamels now under way include measuring opacity of enamels (1); improvement of porcelain enamel in regard to its application on steel (16); mechanics of adherence of vitreous enamels to metals (1); development of test data and specifications for the kitchenware industry (15); study of chemical durability of porcelain enamel surfaces; investigation of the use of various clays in porcelain enamels; and ceramic coatings for exhaust systems (15).

Glass

Basic glass research has been conducted on such problems as the relationship of structure and vitreous properties, the effect of thermal history, definition of the vitreous state, homogeneity, rates of diffusion, and fluorescence of glass. New applications of glass have been filling wartime needs.

Methods of glass preparation vary considerably, and the degree of homogeneity achieved is a reflection of the complete past history of preparation of the glass. The major factors involved include temperature, time, batch formulation, uniformity of mixing, segregating tendencies, convection and mechanical stirring, and physicochemical relations in the batch-glass-refractory system. The rate of homogenizing of soda-lime-silica glass under conditions of minimum convection mixing and in the absence of refractory materials has been studied by the centrifuge density spread technique. In the absence of any furnace refractory and under conditions of minimum convection mixing, this soda-lime-glass increased in homogeneity rapidly during the first 16 hours in melting and at a much slower rate with additional melting time. The portion of glass responsible for the major part of the density spread was lower in density than the parent glass corresponding to a glass higher in silica. This fraction was concentrated in the top half of the melt in each of the two melts on which such a determination was made, indicating the tendency for silica to concentrate at the surface during melting.

In the melting of glass, the penetration of heat through the surface down to the deeper sections is very important. In certain colors, the penetration is only a fraction of what it is in others, i.e., the temperature gradient down through the glass may be very steep. Experimental studies of the temperature gradients in glasses of various colors have been made. Ferrous oxide and chromic oxide yielded the largest gradients, whereas selenium, cerium, and very small amounts of cobalt gave small gradients. Visible color or color intensity was no indication of temperature gradients.

A series of fundamental experiments was made to study the nature and the rates of diffusion from certain compounds for a number of time and temperature intervals (15). Diffusion took place from a salt into a lime-soda-silica (commercial flint) glass in all cases. The optimum test conditions were a temperature of 900°C. and a test time of 108 hours. Of the salts tested, viz., $AgNO_3$, $AgCl$, Ag_2SO_4, Ag_2O, Cu_2Cl_2, $CuSO_4$, V_2O_5, $CrCl_3$, $PbCl_2$, Tl_2SO_4, $AuCl_3$, $PtCl_4$, Co_3O_4, and $FeCl_3$, those of Ag, Tl, and V diffused. The increasing order of ionic sizes is V, Ag, and Tl, which corresponds also approximately to the rates of diffusion.

Cu salts showed a reaction with the glass with a possible diffusion. The rate of diffusion for $AgNO_3$ at a given temperature was practically constant up to about 10 hours of test time and then decreased. The increase of diffusion for a given time with temperature rise was more rapid. A break was noted at the softening temperature, and another break probably was present at the temperature of rapid decrease of viscosity. Fick's law held only for a limited time at the beginning of the experiment; the so-called diffusion constant was therefore not constant throughout the entire test period. The concentration gradient was a straight line approaching the distance axis asymptotically. The size of the particles in the colored bands in the specimens above the softening point, therefore, does not vary progressively because the number does not vary continuously. In the gray diffused portion, Liesegang rings were found under certain experimental conditions.

The structural homogeneity of glass has received more attention. Study of the mechanical strains present in a sample of glass does not enable prediction of the future behavior of this glass. There is no simple relation between such strains and the physicochemical state of the glass. Most of these states can be obtained with or without birefringence, depending on the thermal treatment to which the glass was submitted. If the glass is not in the equilibrium condition for the temperature at which it is being used, it will transform spontaneously toward that equilibrium. The birth and evolution of strains depend on these physicochemical unbalances as well as on other characteristics of the glass. Only the study of the physicochemical state can give reliable indications of the behavior of glass in practical use. The difficulty of defining the vitreous state in a rigorous manner, the existence of many borderline cases, and the theoretical requirements which must be met if a substance is to be vitreous have received continued discussion. If a substance possesses a degree of rigidity comparable to that possessed by typical crystalline substances yet lacks the dependence on direction (characteristic of the crystalline state) of such properties as hardness, rate of growth, and solution, it is said to be in the vitreous state. From the structural viewpoint, the vitreous state of matter may be defined as that state in which the arrangement of the component atoms, ions, or molecules possesses a permanence similar to that in the crystalline state and a randomness similar to that characteristic of liquids. A rigorous definition of a vitreous substance is impossible without the introduction of purely arbitrary quantitative limiting values for the rigidity and the dependence of various properties on direction or for the degree of permanence and lack of order in the atomic distribution. The theory for vitreous silica, that each silicon atom in silicon dioxide is tetrahedrally bonded to four oxygen atoms and each oxygen is bonded to two silicons by bonds making approximately tetrahedral angles with each other, has been verified by X-ray studies. Because of the possibility, without much energy change, of different orientations of each Si—O bond relative to the other Si—O bond leading from the same oxygen atom, may different atomic arrangements have nearly the same stability. The most stable of these at room temperature is quartz, but at much higher temperatures many less regular structures exist in equilibrium with each other. A change from one of these structures to another involves (in most instances) the breaking of relatively strong Si—O bonds. The activation energy for this change is so large that the rate must be negligibly slow at ordinary temperatures. Sudden cooling of the melt, through the temperature range within which this rate is not negligible, therefore "freezes in" the irregular arrangements, producing silica glass. Other pure oxides which have yielded glasses on rapid cooling from the molten state include B_2O_3, GeO_2, ZrO_2, P_2O_5, As_2O_3, As_2O_5, Sb_2O_3, and Bi_2O_3, and possibly P_2O_3, V_2O_5, and Sb_2O_5. In most silicates, both crystalline and vitreous, the silicon—oxygen bonds are much stronger than any others present. In silicate crystals, each silicon is tetrahedrally surrounded by four oxygens and each oxygen is bonded to either one or two silicons. Evidence regarding the structure of silicate glasses favors the assumption that a similar state of affairs also exists in these silicates.

The study of fluorescence in glass is interesting from both the theoretical and practical viewpoints. The phenomenon of fluorescence is significant theoretically in that it represents an inner expression of the atoms and molecules and therefore can give information on their structure and behavior. The fluorescing center is influenced to a certain extent by its neighbors, and fluorescence is therefore an excellent method for investigating the hyperfine structure of matter. Modern fluorescent lighting is the outcome and the cause of the intensive study of the fluorescence of solids in general. The more efficient fluorescence of crystalline substances as compared to glasses has led to comparative neglect of the study of fluorescence in the latter.

The influence of composition and temperature on the fluorescence of glasses containing cuprous oxide and stannous oxide has been investigated (15). Secondary cations reduced the fluorescence of uranium in the glasses studied, depending to a certain extent on the electrostatic conditions they produced in the glass structure. The intensity of fluorescence, as well as the structure of the spectrum, diminished in the order of phosphate, silicate, and borate glasses of equivalent compositions, which showed that fluorescence is favored by increase of oxygen in the glass structure without increasing the interfering secondary cations. Raising the temperature greatly diminished the intensity of fluorescence as well as the structure of the spectrum of glasses containing uranium. The fluorescence of the glasses containing cuprous oxide and stannous oxide as activators seemed to be favored by increase in lime and increase in silica. A peculiar property of this type of luminescent glass was a maximum which is exhibited in its fluorescence-temperature relationship. There were indications that electrons were set free from the excited centers (copper atoms or small groups of copper atoms), which wander about in the glass structure.

Investigators in the field of glass technology are interested in the effect on properties of glass of the addition or substitution of a certain component. Methods have been devised for the calculation of density and various optical properties of a glass from its composition. More recently equations have been evolved for the calculation of density, refractive index, and other optical constants produced by the addition of a known relative weight of a given component to a base glass. Corresponding equations were set up for the substitution of one component for another. Values were computed for the initial fractional rate of change of refractive index when various components were added to pure SiO_2 and to a sodium silicate glass. Graphs have been presented showing the variation with atomic number and with group of the periodic table of certain constants entering into the calculation of densities, refractive indices, and dispersion of glasses.

Problems involving the rapid identification of small amounts of special elements present in ceramic raw materials and products have been solved by the use of organic microchemical tests (7).

Theoretical aspects of the chemical attack of glasses by water have received attention. The effects of time and temperature on the chemical attack of glasses by water have been represented by the equation $a \log N = \log \theta - (b/T) + c$; N = attack; θ = time; T = absolute temperature, °K.; a, b, and c are experimentally determined constants. The constant, b, of the equation is independent of the glass composition and of the size and shape of the sample tested and has a value of 5080 for tests of ordinary glass containers. As a time-temperature function, the equation may be written as $\log \theta = (b/T) - C$, in which form it is useful for estimating the storage or service conditions equivalent to an accelerated test or for calculating the conditions of alternate tests. Data from the literature were used in demonstrating the accuracy and usefulness of the equation.

Products frequently are kept in glass containers for several years before being removed for use. A study has been made of the effect of glass on alcoholic products stored in bottles at room temperature for three years. The pH

change of the products studied when stored in commercial bottles was inversely proportional to the chemical durability of the glass. The importance of the chemical durability of glass used for storing alcoholic products was definitely indicated.

A study has been continued on the long-time aging of thermometers at constant temperature (7). The change in readings of a fixed point, such as the ice point, normally followed an exponential law. It is believed that the exponential law is due primarily to bulb shrinkage under the influence of a single molecular mechanism in the glass. The methods of mathematical analysis presented are believed useful for evaluating the effects of accelerated aging treatments on glass.

During the past year, a study was undertaken to determine the effect of bomb explosions on glass and other glazing materials (21). On the premise that only by means of an explosion can the effect thereof be determined, a satisfactory test method was devised. A small frame house was erected where various charges of dynamite could be detonated at fixed distances from a large window in front of this building. Results were recorded with a slow-motion camera so that a complete analysis of their significance could be made.

Considerable work is under way on glass-to-metal seals and ceramic-to-metal seals. Kovar, an iron-nickel-cobalt alloy, matches the expansion of hard or thermal-shock resistant type glass. The seal between Kovar and glass is a chemical bond in which the oxide of Kovar is dissolved into the glass during the heating process. Kovar-sealed terminals and other assemblies designed for soldering, welding, or brazing to metal containers to form vacuum- or pressure-tight seals are finding increasing usage. Much work has been done on metallizing glass and ceramics for various hermetically sealed components.

The need for hermetically sealed insulating bushings became evident with the advent of liquid- and gas-filled electrical apparatus operated under pressure. One method of producing a sealed bushing is to use a solder joint between a previously metallized porcelain or glass surface and the required shapes. Another method is to use glass in place of solder to join the porcelain to the metal, the glass and metal having a thermal expansion coefficient near that of porcelain. Another solution to the problem of producing a sealed bushing is to make it of glass with sealed-in metal inserts that can later be attached to the apparatus by soldering or welding. The glass and metal inserts have comparable thermal expansion coefficients providing a matched glass-to-metal seal. The availability of gas, oil, and vacuum-tight, lead-in bushings has presented new possibilities to the designing engineer and will undoubtedly result in electrical apparatus of greater efficiency and longer life.

Continued advances have been noted in the development and uses of glass fibers. Fiberglas is produced in two forms, as a wool and as a textile. This product has been used as an effective replacement for materials like cork, nonferrous asbestos, aluminum, and mica and is becoming important as a strategic material in the war program for thermal and electrical insulation.

Glass is being used as a substitute for mica in fixed capacitors. One method involves the spraying of the glass to form a thin coating on the capacitor plate material and thus serve as the dielectric, whereas another method uses very thin sheets of glass in alternate layers of glass dielectric and capacitor plates.

Glass-bonded mica products have found increasing use as electrical insulation in many electronic applications. This material can be molded and machined to closest tolerances and its surface polished so that its absorption is negligible.

The Multiform process, a new method of glass fabrication developed by the Corning Glass Works, is applicable to a number of glass compositions having widely different characteristics and permits fabrication of shapes not readily produced by the conventional methods of glass fabrication. The properties of Pyrex-brand Multiform ware are determined by the basic glass compositions used in its manufacture. Low loss factor glasses are being used in the production of high-frequency insulation. These glass insulators have high electrical resistance, low surface conductivity, good strength, and are resistant to corrosion and thermal shock.

Other work on glass under way includes investigation of methods of coloring glass (16); possibilities of use of selenium to obtain colors other than pink or ruby in glass (16); technical glassware (21); plate glass (21); development of special surfaces on glassware (16); study of thermal shock in glasses (15); phosphate glasses for special uses; corrosion of refractories by glass (15); use of glass for precision gauges; use of glass-lined chutes; and use of metallic oxide glass containing no silica.

Materials

The raw materials of the ceramic industry are minerals, supplemented by certain organic chemicals to improve workability or mixed with chemicals of mineral origin. Many ceramic raw materials are at least in part imported, and these are the ones which have posed problems for domestic producers. The Bureau of Mines and others have given much attention to the strategic, critical, and essential minerals needed for war production (17).

Talc for the so-called steatite ceramics needed for radio insulation is one of the materials formerly imported largely. Such talc should be of high purity, but the war standards of purity have been relaxed to talc containing not over 1.5% each of lime and ferric oxide and not over 4% alumina. After Pearl Harbor, all foreign sources which had normally supplied the industry were cut off because the material had come from France, Italy, and Manchuria and from one domestic supplier in California. Possible supplies from other talc mines had to be canvassed and tested for chemical and physical properties, the final test being to actually make up insulator bodies and test them electrically (18 and 22). Froth flotation of low-grade talc was also tried and gave very desirable products, as talc is a material that is easily froth floated. During 1943, the problem was regarded as solved, from the raw materials standpoint, because a number of different mines were found which could supply talcs that could be blended to give materials of satisfactory working behavior.

A source of block talc or "lava"-grade talc is being developed in Montana (17).

Indian kyanite, a variety which remains strong in coarse pieces after calcination, was badly needed earlier in the war for special refractories when transport from India was difficult. Domestic materials have received consideration as possible substitutes for Indian kyanite, including domestic kyanite, South Carolina topaz, California andalusite with diaspore, diaspore clays, electric-furnace mullite-corundum, and low- and high-grade bauxite (18).

South Carolina topaz was found to be the nearest substitute. Except for bauxite and electric-furnace corundum made from high-grade bauxite, only a small portion of the reserves of the foregoing materials is needed at the present time to produce goods necessary for the war. Electric-furnace products, however, utilize power and equipment, which in certain districts are needed for other purposes. A further study was made on the effect of heat on kyanite and topaz and the load resistance of refractories at elevated temperatures. The effect of the fluorine gases generated during calcination of topaz was noted, and mixtures of topaz and domestic kyanite flotation concentrate were found to calcine to strong high P.C.E. articles. Some further work was done on these mixtures with the idea of making a lightweight brick of high refractoriness, and some of these brick are even now under operating tests to prove their value (18).

Forsterite, made by electric fusion of olivine with enough reducing agent to remove iron and corresponding silica from the olivine, has been the object of study for several years (18). The data on how to produce it and how to cast it into usable blocks and also on the behavior of brick fabricated from forsterite grog have been published. At present, larger scale testing in industrial furnaces is the program, somewhat delayed by pressure of other war problems.

The tight situation on the bauxite supply has caused

much research on clays as raw materials for producing alumina for the aluminum industry. Many of the large clay deposits of the western states have been drilled and tested for possible use in alumina production. Two plants are in the course of construction to produce alumina from kaolin.

There is an increasing need for improved processes of recovering magnesia from dolomite, magnesite, magnesium-bearing salt brines, and similar raw materials. An exhaustive survey of the literature indicated there are many methods of recovering magnesia from these materials. For refractory purposes, a magnesia product that contains approximately 90 to 92% MgO, 5% SiO_2, and the remaining CaO, Al_2O_3, and iron, is preferable in commercial practice to a highly refined magnesia. This product can be obtained most economically in large volumes by a combination of chemical and physical methods. Among the most popular processes of this type are those in which sea water or brine is treated with lime or calcined dolomite.

A new type of magnesia possessing unusual physical and chemical properties is being produced from brucitic limestone near Wakefield, Quebec, and is being used for making basic refractories for the copper, steel, nickel, and other metallurgical industries, for making a special grade of paper needed in munitions, and for various other ceramic uses. The dead-burned granules possess certain physical properties that make them highly desirable for producing fired and chemically bonded basic brick.

Flake graphite, a material normally imported largely from Madagascar, is used in making graphite crucibles and steel-ladle stoppers by well-known ceramic processes. The larger the article the larger the grog needed to fabricate it, and during the present war the graphite crucibles most needed are the larger ones which form parts of electric melting furnaces. Hence, the large tough Madagascar flakes were most wanted but the supply was intermittent, uncertain, and at times was cut off. The known deposits in Alabama and other states were explored (17). A flow sheet was developed that also applied to the ores in New York, Pennsylvania, and Texas. Two old plants were rehabilitated and three new ones were erected to concentrate graphite flake. In recent months, shipping has improved and a supply of Madagascar flake has eased the situation.

In the field of fluorspar, the ceramic grade is intermediate in purity between the chemical and the metallurgical grades and, although in general there has been a shortage of fluorspar, the situation has never been bad in the ceramic field. The ceramist, furthermore, can adapt himself better to substitutes than the two other main users. Cryolite, the other fluorine mineral used by ceramists, has been devoted entirely to aluminum production except that recently there has been some ease in the supply. Topaz is being tested as a possible substitute for metallurgical fluorspar.

Many new developments in nonmetallic minerals have been noted. Anthrophyllite asbestos, rutile, and wollastonite are finding use in ceramic welding-rod coatings. Anorthosite is being used for the manufacture of Portland cement extracting alumina from the cement mix as a by-product. $CaCO_3$ is being recovered in Germany from sugar-beet scum for use in the manufacture of Portland cement. Reflectivity of concrete can be increased 15% by the addition of 30% lime to the mixture, thus improving illumination of factories. Garnet is being used as a substitute for corundum in the grinding of precision lenses. Gun sights of perfectly clear Iceland spar have been developed. Larger quantities of foundry sand can be reclaimed if vinsol resin is used as the binder. A process has been developed for producing magnesium from serpentine.

A new lightweight aggregate composed principally of bentonite has been developed for the Maritime Commission. It will be used for concrete ships and barges. Another lightweight aggregate is composed of pulverized slate mixed with organic matter and a binder. It is pelletized or briquetted and bloated in rotary kilns. The burning-out of the organic matter produces a very lightweight material. Perlite, a volcanic glass, containing a large percentage of combined water, is heated and caused to explode like popcorn, producing a cellular mass six to seven times its original volume.

A new heat insulator is in the process of development. Silica gel is heated under enough pressure to prevent evaporation within the gel. Under these conditions, no gas phase forms until the critical temperature of the liquid is reached. At this point, the liquid phase is converted to the gaseous phase instantaneously, thus avoiding a gas-liquid interface. The gas may then be withdrawn without causing the collapse of the solid structure. The resulting mass contains as much as 95% air space and weighs 1.8 lb. per cu. ft.

Research during the past year has resulted in the production in this country of synthetic rubies and sapphires of color and hardness equal to the prewar European stones. They are now used for jewel bearings but after the war will be used as gem stones. Jewel bearings are being produced from borosilicate glasses.

A study has been under way to develop a simple method to be used in the evaluation of clays (22). The unreliability of the benzidine color reaction as a test for montmorillonite prompted this work. A rapid rehydration (65°C.)-dehydration (300° to 600°C.) test was developed (duplicate samples subjected to 2 hours' dehydration at 300°C., followed by a 2-hour rehydration period of 65°C. for one sample and a 2-hour dehydration period at 600°C. for the other). Ninety-five different clay samples were tested. A classification was set up, based on the results of this rapid test, which afforded a quick and simple method of typing clay samples received for evaluation. The test can be completed within five hours and is relatively independent of the personal equation. A syllabus on clay testing has been published (*U. S. Bur. Mines Bull.*, No. 451)* which is devoted to qualitative estimation as to the probable uses of a specific clay. The second phase of this work will deal with quantitative estimation as to the value of a specific clay for definite uses.

A research was undertaken to determine a suitable method for spectrochemical clay analysis for trace elements so that their effect on the physical properties of the clays could be studied (3). A procedure was reported for the complete qualitative analysis of clay to cover both volatile and refractory elements. Best results were obtained by using both the cupped electrodes and the high-streaming velocity arc. The quantitative procedure utilized the graphite dilution of the sample with the graphite containing the internal standard as a means of introducing the internal standard and to increase the possible concentration range.

The thermal and moisture expansions of ball clays and bodies fired to different temperatures have been studied. The data obtained for the ball clays tested indicated that the thermal and moisture expansions characteristic of the clays themselves are not reproduced in the same order in bodies of which the clays are a part. The similarity in this respect, however, as well as other physical properties of the majority of the clays originating within proximate geographic locations, permits their classification into groups for which their behavior may be predicated, both alone and in bodies.

During the last few years in studies on thermal curves of kaolins, it has been noted that the heat required to drive off the chemically combined water in a number of instances has been considerably greater than that determined for the pure kaolinite mineral. This has been especially true in certain size ranges. One explanation given was that a certain size range may include a proportion of a mineral having a higher water content than kaolinite, such as gibbsite or diaspore. There also might be a variation in the physical properties of the specimens with particle size, such as diffusivity, which would permit a relatively higher temperature to be developed in the test samples in some cases. There were indications that kaolinite may be a mixture of two similar minerals, one requiring more energy to drive off combined water.

* See *Ceram. Abs.*, **22** [8] 146 (1943).

A method has been developed for determining the soluble sulfate and total soluble salts in ceramic raw materials and bodies (18). Ball clays and bentonites were found to have the highest sulfate contents, and the content in the china clays was generally low. The study brought out some interesting facts concerning the relationship of clays and soluble salts. These salts may cause viscosity and dispersion problems in the casting of slips as well as defective glaze qualities on bodies. Quantitative data confirmed the well-known fact that $BaCO_3$ is effective as a sulfate precipitator in clay slips.

A careful study has been made of six monodisperse kaolinite suspensions in regard to their viscosity and thixotropic properties, as well as yield point (2). From these data, it has been possible to develop a mathematical relation correlating these factors with the concentration which covers the whole range of flowable suspensions. This is a distinct step forward from any of the proposed formulas that have been previously suggested. Monodisperse fractions of kaolinite taken from a number of different whiteware clays when thoroughly cleaned and of the same particle size appeared to be substantially alike no matter from what source they were derived. Work has been done on the velocity of transfer of monodisperse kaolinite particles in an electrostatic field while suspended in water. These data enable measuring the charge on the particle which will be helpful in studies of deflocculation of casting slips.

Considerable work (2) has been done with the electron microscope in determining the exact size and shape of the clay particles, which gives information not previously available.

The chemical and mineralogical nature of Georgia kaolins have been the subject of extensive study (7). The chemical analysis indicated these kaolins are rich in alumina and are deficient in silica even beyond the kaolinite ratio. The low content of iron oxide and magnesia was consistent with a conclusion that montmorillonite is not present to a great extent. Georgia kaolins are classed as soft, semihard, and hard by the producers; these designations correlate with grain size, i.e., a coarse clay is softer than a fine-grained clay. If, however, hardness is assumed to include erratic colloidal behavior, factors other than grain size may then be important because the admixture of other minerals and the presence of organic matter greatly affect viscous properties. Two kinds of hard kaolins were recognized; those which are hard only because of grain size and those which are hard because of the presence of organic matter or clay minerals of high base-exchange capacity. The outstanding difference between the hard and soft kaolins, however, seemed to be in the degree of development of kaolinite, the soft clays showing a greater crystallization than the hard clays.

A "white clay" from Centre County, Pa., which analyzed 68% total SiO_2, was the raw material used in a series of beneficiation tests (7). The mineral constituents were roughly 59% quartz and 40% kaolinite. By a combination of size separation and froth flotation various beneficiated products were prepared.

The problem of the more efficient use of slate and slate waste has been attacked. Much detailed investigation will be necessary to determine fully the precise properties of slate which will make it valuable for a variety of uses, to develop the most effective methods of measuring these essential properties, and to learn how to modify the properties to make the most desirable features predominate.

A study is in progress on the principal ceramic resources in Alabama, the shales, and the clays underlying the coal seams (5). The shales under investigation were not limited to those of the coal measures but included those held by other formations as well. The research is being directed largely toward the development of new uses for these materials.

The particle-size variations of eleven shipments of commercial flint and of fifteen shipments of feldspar have been investigated as a possible cause of production variations in electrical porcelain (23). The sieve data have no value in comparing materials as fine as the nonplastics generally used in whiteware manufacture. Such materials, however, may be expediently controlled by means of sedimentation analyses. The Andreasen pipette method was satisfactory for the laboratory determination of particle-size distribution of flints and feldspars in the subsieve range of 1 to 50 microns. For plant control of particle-size distribution in the subsieve range, the hydrometer method was considered adequate. The plotting of particle-size data on logarithmic-probability graph paper provided a satisfactory procedure for the representation of particle-size distribution of ground materials. Specific surface (sq. cm. per gm.) values are easily calculated from such plots and are useful for comparing the fineness of different samples. Some samples of feldspar were peptizable in the particle-size range below 5 microns. All samples of the feldspar were found to be surface-active, but none of the flints showed this property. Nonpolar liquids were not suitable suspending media for sedimentation analyses. The sedimentation velocities of very fine powders and surface-active powders were also greatly affected in aqueous media by many electrolytes.

Other researches on materials include organic content in ball clays (1); the influence of length of span and method of loading on modulus of rupture of clay bars (1); use of chlinochlore in ceramic bodies; deformation study of the $MgO–B_2O_3–SiO_2$ system (1); use of eyrite in steatite bodies (1); use of celestite in glass; gypsum (21); development of lime insulating material and acoustic plaster (16); manufacture of finishing lime and processes involving use of plaster of Paris (16); development of ceramic ware bonded with resins (16); research on abrasives (21); sintering of chrome ore (1); development of improved electric arc-welding electrodes for steel and for aluminum (16); development of ceramic space heaters for the housing program (2); use of strontium compounds in ceramics (15); silica fluoride reactions in ceramics; and thermal-expansion characteristics of some artificial silicates (15).

Refractories

The recent intensive development of refractories from lime and dolomite has revived interest in some of the properties of dolomite-silica brick. The mineral constituents of these refractories are usually $2CaO \cdot SiO_2$, MgO, and $3CaO \cdot SiO_2$, together with minor constituents. Observations have been made on the solid-phase inversions of calcium orthosilicate (16). The stability of $2CaO \cdot SiO_2$ in refractories can be achieved most effectively by crystal-chemical methods. The addition of 1% of P_2O_5, B_2O_3, and As_2O_5 or V_2O_5 as the oxides or the Ca salt will provide crystal-chemical inhibition, if the addition is dissolved in the $2CaO \cdot SiO_2$ lattice by sufficient heat-treatment and if the addition is adequately distributed. Chromium oxide, added either as the oxide or as chromite, was found to be a less effective chemical inhibitor (7). Inhibition can also be achieved by purely physical means provided enough compatible crystalline or vitreous material is admixed with the $2CaO \cdot SiO_2$ so that grains of the latter are isolated. The mechanism of crystal-chemical inhibition of the beta to gamma inversion involves the preservation of a part of the Ca atoms in low coordination (i.e., with 4 instead of 8 oxygen ion neighbors) in the $2CaO \cdot SiO_2$ lattice. This inhibition depends on the solid solution of certain acid oxides in the high-temperature beta lattice, their insolubility in the low-temperature lattice, and their sluggish exsolution or precipitation from the beta form. The active role of these network Ca atoms in the high-temperature lattice contrasts strongly with the inactive role of the Ca atoms in the uninhibited low-temperature gamma lattice. Physical inhibition depends on the isolation and constraint placed on the $2CaO \cdot SiO_2$ particles by interstitial material surrounding the grains.

Two methods of mineral analysis have been applied to silica brick in an attempt to estimate the amounts of quartz, cristobalite, and tridymite in a brick (7). In the first method, heavy liquids were used to separate the quartz from the cristobalite and tridymite. Despite the close intergrowth of the phases, some success was obtained. The second method was based on the volume expansion of

cristobalite on inversion from the alpha to beta form in the temperature range of 200° to 275°C. It was hoped that the percentage of cristobalite could be estimated from the volume expansion of a particular sample. Some success can be held out for the methods, but the numerous experiments run to prove the method provided much interesting data concerning the fundamental properties of cristobalite and the relationships between the volume expansion, temperature of inversion, and the heat-treatment history of the sample. This fundamental work on cristobalite is being continued (7).

The subject of mottled silica brick has been of great interest for many years to the user as well as the manufacturer of refractories. Considerable time has been spent in the study of causes of mottling. The extent of coloration is dependent on the amount of lime and alumina and on the thermal history. The coloring agent is usually iron oxide which is present in small amounts. Color is dependent on the grind and on the mixing, drying, and burning procedures. The color can be cleared up or accentuated by controlled laboratory reheating at known temperatures for definite time intervals. The mottling does not appear unless the brick are well burned. Mottling can be avoided and a very white brick can be produced by the use of ganister containing about 2% of alumina or by the addition of clay to the brick batch, but this process sacrifices the refractoriness. The character of a silica brick depends on its physical properties, workmanship, and performance and not on its color.

From a standpoint of works control, the most important factors related to the color of the product are the setting and firing. To produce cream-colored brick with a minimum of spotting, there should be good circulation of kiln gases and the brick should be burned to cone 18 down. Sulfur gases in the kiln may possibly play a subordinate role in producing spotting. A considerable excess of air during the early stages of firing should minimize the effects of the sulfur gases. To produce cream-colored brick, the lime content should be carefully controlled and should be neither too high nor too low. Ganister high in iron oxide will produce brick of reddish color.

An extensive work on mottled silica brick led to the following conclusions (21): The mottled areas of the silica brick can be changed to the typical light cream color of the product by heat-treatment. Any silica brick apparently can be darkened in color by heating for a sufficiently long time at a suitable temperature. A slow rate of cooling of heated brick is required to develop the color, and the normal cream color results when such brick are cooled at a fast rate. Sulfur does not appear to be a factor in color formation other than through the possible formation of the more soluble $CaSO_4$ during the drying operation. Microscopic examination indicated that the color-forming process proceeds through the development of wollastonite that may contain iron in solid solution which separates from it with heat-treatment, forming an iron-bearing mineral that is strongly colored.

Laboratory studies have been made chiefly on the effect of various atmospheres, such as air alone and mixtures of air with CO_2, CO, and SO_2 correlating with such factors as time and temperature. The staining of silica brick was found to occur in a critical temperature range of 900° to 1000°C. Concurrently the brick had to be "soaked" in this temperature range and exposed to an oxidizing atmosphere. Stained brick can be "cleaned up" or staining prevented by manipulation of the foregoing set of conditions as well as by additions of 4.5% or more of lime. The experimental data examined in the light of the system CaO–Fe_2O_3–SiO_2 suggested that the colorant is the mineral dicalcium ferrite.

A recent application of silica brick required that the refractories should be unaffected by steam at high temperatures. A test was devised in which the temperature could be measured within ±10°C. and the atmosphere surrounding the test specimen could be controlled. Bars cut from silica brick of normal composition and subjected to the action of water vapor for 5 hours at 1593°C. showed no bending or softening but did show a slight surface glaze. On the basis of a 16-hour laboratory test, water vapor appears to have little or no effect on American silica brick of normal composition at temperatures up to 1593°C.

A study has been made of the oxidation of iron in iron-bearing silicates (7). When a silicate mineral containing divalent iron as a lattice constituent is heated in air, the iron is oxidized and rejected from the lattice. The information obtained is of interest in the manufacture of basic refractories.

The effect of coating insulating firebrick with aluminum–fire-clay mixtures has been reported (3). After insulating firebrick are reheated in service, many of them contract too much and develop large open shrinkage cracks. By first applying to the surfaces a 0.035-in. coating composed of aluminum and fire clay, these brick usually remain intact and constant in size when they are reheated. The coating also becomes hard, causing the brick to become more resistant to abrasion, slag action, permeability of gases, load at high temperatures, and sudden temperature changes. Coatings composed of 60 to 70% of fire clay and 30 to 40% of aluminum powder overcame most of these deficiencies in insulating firebrick.

Other work on refractories includes a study of high heat duty refractories (19); development work on siliceous refractories (16); fundamental data on the preparation and use of silica furnace linings (19); development of refractory mixes to be used in conjunction with welding operations (16); and general research on refractories (21). A report was made of studies conducted to select a plastic refractory suitable for Navy use.

Structural Clay Products

The Structural Clay Products Institute is sponsoring a research project on moisture penetration tests on masonry tile walls (12). The Glazed Brick and Tile Institute has a research under way consisting of studies of the fire resistance of glazed-brick construction and the weathering resistance of glazed structural clay products (19). The National Clay Pipe Research Corporation is sponsoring a research for the development of better practices in sewer-pipe manufacture and use (19).

Studies have been made during the past two years on present unit masonry sizes as used in conventional building construction and their adaptability to a coordinated system. A significant relationship exists between present unit sizes in height, thickness, and length and a 4-in. modular dimension. There was little consistency, however, in the assembly of these units in similar or composite walls and far less in the coordination with component building materials and equipment. Single masonry units based on whole multiples of 4 inches were recommended with consideration given to the various joint thicknesses. Standardization of unit sizes has been proposed to obtain maximum simplification and corresponding economy to meet postwar construction requirements.

A study has been reported where the durability record of various glazed tile was compared with hardness values determined by the microcharacter instrument (24). A comparison of the k values indicated that the lower limit representing satisfactory durability may be taken as $k = 1000$. Materials showing k values above 1000, including glazed floor tile, have acceptable wearing qualities. In the case of glossy surfaces, a k value of 1200 or more is definitely preferred, because on such a surface incipient wear becomes easily apparent. The k values were found to correlate with durability records.

Simplified thermal-expansion rings have been used for production control in terra-cotta manufacture. Die extrusion of expansion rings provided for quantity production of rings of such accuracy as to give reliable results. Expansion rings afford an excellent means of registering the glaze and body stress relationships, and they may be used to predict accurately the degree of weather crazing caused by moisture expansion.

Expanded vermiculite has been studied for use with a low-vitrifying plastic clay bond to form structural clayware, such as partition tile and bathroom tile, which may carry glazed coatings in decorative effects (24). The firing

range for these clay-vermiculite bodies was from cones 08 to 04, and a ratio of clay to vermiculite of 1 to 6 to 1 to 4 by volume gave the best combination of qualities. A structural unit can be produced which has a compressive strength of 1000 lb. per sq. in. The glazed or unglazed product will receive nails or can be sawed and fitted much the same as wood. It is particularly adaptable for backing-up material but may be used for partition walls or any load-bearing wall where the indicated compression strength meets specifications.

Lightweight prefabricated boards for building purposes are being produced from a mix of cement and vermiculite. Also, partition and wall tile and insulating brick are being produced using clay as the bonding agent.

The process of improving the quality of structural clay products (in many cases reducing costs) by adding soda ash to the clay to control pH and the character of base saturation has found application in a number of plants.

Other structural clay products studies include new processes in the floor- and wall-tile industry (2); effect of additives on concrete (16); development of cellulated clay aggregate for use in the cement industry (19); increasing the adherence of bitumen to road aggregates (16); and rates of moisture loss in the drying of brick (15).

Whiteware

The expansion in high-frequency application incident to the development of radio and ultra-high frequency devices has led to an increasing demand for improved electrical insulation. These demands have been met to a considerable extent by expansion of facilities for steatite, low-loss glasses, and glass-bonded mica products. Organic types of insulation are being used where the properties of the ceramic are not required. In view of the current need for high-frequency ceramic insulation and the probable future usage in all types of electronic equipment, developmental work has been under way on zircon porcelains (23). Zircon porcelain has several important advantages in manufacture and properties over the steatite porcelains. The zircon porcelains may be processed by any of the methods used for the production of conventional porcelains. The firing temperatures and vitrification range of zircon porcelain are such that a completely dense uniform product is commercially attainable without the necessity for the extremely close firing control required for steatite. The zircon porcelains are at least equal to steatites in all important mechanical properties. An outstanding advantage has been noted for zircon porcelain in its thermal-shock resistance. The high-frequency electrical properties of zircon porcelains are superior to those of the average grade of steatite commercially available.

Ceramic bodies of the three-component system, $MgO \cdot Al_2O_3 \cdot SiO_2$, with additions of various fluxes, have been investigated. Feldspar, nepheline syenite, and feldspar-zinc oxide, used as flux in these vitrified cordierite bodies, offered the best possibilities. Although it was also possible to obtain vitrified bodies with spodumene and feldspar and with beryl and feldspar, none of these developed self-glazing bodies; repeated firing tests furthermore showed these bodies had too short a firing range for practical application. The mechanical and electrical properties of some of the best bodies compared well with those obtained with regular feldspar-flint-clay bodies used for electrical high-tension work.

Associated with many of the domestic talcs are small or moderate amounts of iron occurring as magnetite, chlorite, pyrrhotite, actinolite, and staining films of iron oxide. The possible use of ferruginous talcs in steatite dielectrics has been investigated (9). Several iron-bearing talcs were fired alone and in body form, and the physical and electrical properties were measured. Small amounts of ferric oxide exerted little or no detrimental effect on the dielectric properties of a steatite body, especially at higher frequencies and low temperatures. Iron impurities in larger amounts gave an increased power factor and a slightly increased dielectric constant. The effect of dielectric loss became especially marked at low frequencies and high temperatures. Within limits, certain ferruginous talcs may be used in steatite dielectrics without serious detriment, other than that of uniform coloration, on either the firing or electrical properties if oxidizing conditions are maintained during firing.

The effect of iron on steatite firing has been the subject of an investigation. It has been found possible to estimate the iron in a talc by firing to a specific temperature and measuring the color by a reflectometer. The iron content of talc has a very definite influence on the shrinkage. Formerly it was thought that only the lime and alumina affected shrinkage; this investigation showed, however, that all the members of the R_2O_3 group control this factor. The effect of particle-size distribution on steatite firing has been studied. Particle-size distribution has a very great effect on shrinkage not only on the straight talc but also when the talc is used in various steatite mixes. An increase in fineness resulted in an increase in shrinkage without an appreciable change in absorption. A comparison of the shrinkages with the chemical analyses and particle-size distributions showed definitely that any variation in the shrinkage or absorption of each of the fineness groups was due to a variation in fineness alone and not to a change in chemical analysis. Finer grinding improved the color of the talc, showing that the darker shades shown in the coarser millings were due to an optical quality of the talc crystals themselves, and, as the crystal structure was destroyed, the color was improved.

A study was made of the fired properties of a variety of talc both alone and in a steatite body and the effect of different sources of alumina on the steatite body (1). High lime-low iron talcs have a narrow firing range, fire white, and are highly crystalline. High-alumina talcs have a lower maturing temperature. High-magnesia talcs have a higher maturing temperature. The effects of these variations in steatite compositions were less apparent than in the talcs fired alone. A general idea of the suitability of a talc for use in a steatite body can be obtained from the chemical analysis, but some idea of the mineral impurities present is also needed.

Research has been completed on the development of a suitable method of controlling the linear firing shrinkages of dry-pressed steatite bodies so that articles could be produced with very close dimensional tolerances (16). The research was divided into two phases: determination of those factors that have an appreciable effect on the shrinkage, and developing methods of stabilizing those factors. Experiments definitely indicated that the method used in mixing the dry ingredients did affect surface texture and shrinkage when the forming pressure, binder, granule size, etc., were held constant. The use of the coarse fraction of a talc only in the steatite body effectively lowered the linear firing shrinkage, but a rough fired surface was produced on the product. Variations in particle size of a given brand of the talc within the limits of grinding acceptable to steatite manufacturers, from the standpoint of fired texture produced, did not cause excessive shrinkage variations. The physical nature (type) of talc has more effect on the firing shrinkage than particle-size variations by virtue of the effects on compactibility of the body when dry pressed. The linear firing shrinkage of low-loss bodies was decreased by adding 1.0 to 2.0% of aluminum chloride to the body via the mixing water, which increased the firing temperature 10° to 20°F. The shrinkage ratio depended upon the method of granulating, the moisture content of the granules at the time of pressing, the type of binder and lubricant used, and the shape and size of the piece made. The shrinkage ratio does not depend upon the per cent water used in mixing nor is it related to either the dry or fired bulk specific gravities nor the compressibility factor. The amount of water used in mixing the steatite body affected the bulk density of the granules produced from the body. The amount of water (or other moistening agent) in the granules at the time of pressing should be the maximum permissible without causing trouble from laminations and sticking or excessively reducing mechanical strength. The relationship of volume firing shrinkage to the dry bulk specific gravity of dry-pressed steatite products can be used to determine and control the linear firing shrinkage

of the body for which the data were obtained. The specific gravity curves of one body can be used with another body of the same formula regardless of the brand of the talc or binder-lubricant combinations, but cannot be used with bodies of other formulas. The volume shrinkage of a body was slightly different for each brand of talc employed, even though the body formula and the dry bulk specific gravity are the same.

The crystalline and glassy phases of steatite dielectrics have been studied (9) to determine the effect of some cations of various valences and atomic weights in the glassy phase on the final dielectric properties. No general relation appeared to exist between the dielectric losses and the chemical properties of valence and the atomic weight of all the elements tested in the glassy phase of a steatite dielectric body when they were compared on an atomic equivalent basis. Within groups of elements, such relations appeared to exist as follows: the alkalis showed high dielectric losses, which increased with increasing atomic weight; divalent elements gave low dielectric losses, which were further lowered by increasing atomic weight; the heavier ions also led to higher dielectric constants; trivalent elements generally gave moderate power factors and dielectric constants, and with increasing atomic weight the power factor lowered and the dielectric constant increased; and elements of higher valence and atomic weight had varied effects on the dielectric properties. With increasing frequencies, the power factor generally decreased, but some elements proved to be an exception to this conclusion. At all frequencies, an increase in the temperature also increased both power factor and dielectric constant and, therefore, the dielectric loss factor. The rate of deterioration of dielectric properties with increasing temperature varied and depended on the specific material added.

Titanium dioxide ceramics have found their principal use in condensers which possess high mechanical stability, high capacities in relatively small volumes, and zero-to-large negative temperature coefficients of capacity. These condensers are replacing other types of condensers. The ceramic unit may replace to some extent the mica (conserving this critical material) and, if designed properly, the unit can have the same physical dimensions. The main advantages of the ceramic condenser are the higher Q values or lower power factors and the zero temperature coefficient which is desired in many cases but is not possible to obtain by using mica as the dielectric. Ceramic capacitors will extensively replace electrolytic capacitors because of superior properties and smaller physical dimensions. The titanium dioxide ceramics developed in this country to date may be classified into groups as follows: $K = 80$, having high stable capacities in limited space; $K = 12$ to 18, being nearly independent of temperature; $K = 40$ to 60, also nearly independent of temperature; and numerous ceramic compositions with dielectric constants ranging up to 1,000,000. Research is under way to develop more stable and uniform products, especially in the higher dielectric constant ranges.

Work has been undertaken to develop a suitable method for the quantitative determination of the glassy bond present in a typical whiteware body after various heat-treatments. Petrographic methods, with polished sections and powder mounts, were used for these determinations. A study of the structure of the body and the changes which take place in the body from one firing condition to another can be studied best from the polished section. The determination of the percentage of glass was reproducible by either method and by independent investigators.

Other whiteware body researches include development of heat shock-resistant ceramic bodies (19); special ceramic bodies for insulation purposes (16); work on high-temperature insulation materials (23); development of bonds and methods of fabricating steatite bodies (16); use of various new ingredients in whiteware bodies (16); study of bodies in the clinoenstatite field of the MgO–Al_2O_3–SiO_2 system; investigation of special porcelain bodies for high thermal-shock resistance and high dielectric constant (15); and preliminary investigation of multilayer bodies (15).

The United States Potters Association is sponsoring a research on leadless glazes for vitreous and semivitreous tableware (19).

A study has been made of the effect of opacifiers on the fused viscosity of feldspathic glazes. The fusion characteristics of SnO_2, Opax, Zircopax, and various combinations of opacifiers were determined, all heat-treatments being at cone 12. The good glaze field of the tin glaze was in the same relative position as that of the tinless glaze. SnO_2 additions, moreover, did not increase or decrease the area of good glazes. The fusion characteristics also remained about the same. In the high Ca glaze, the SnO_2 caused a slight increase in the viscosity of the glaze. In the high feldspar and high silica glazes, the Sn had no effect on the fused viscosity. A direct comparison of SnO_2 and zirconium opacifiers was made by studying the fused viscosity of Zircopax and Opax in a separate series and by comparing them with the SnO_2 series. SnO_2 in the percentage to yield maximum opacity was the most fluid of the three opacifiers. In the high SiO_2 and high Ca fields, Zircopax was the more fluid of the two zirconium opacifiers; in the high feldspar field, Opax was the more fluid.

The development of low-temperature glazes (cone 01) to fit the nepheline syenite low-temperature bodies has reached the point where plant trials are under way (19). Results to date are promising. A chrome-brown electrical porcelain glaze was developed using nonessential materials in maximum amount (1). A typical white, electrical porcelain glaze was prepared to which 15% of TAM stain and 3% of MnO_2 were added. The clay content was also replaced with Albany slip clay and Michigan slip clay. One blend gave a glaze equal in all respects to the various commercial chrome-brown glazes.

The use of diatomite as a source of silica in ceramic glazes has been reported (25). Glazes containing diatomite were superior to those containing flint in every property except color. The glazes were more brilliant than the corresponding flint glazes and matured at a lower temperature.

A study has been made of the relative importance of the various factors controlling the development of hard luster glazes (3). Various metals in small quantities, singly and in various combinations, were ground in lead and leadless glazes. The most important factor seemed to be the establishment of complete reduction and prevention of re-oxidation on cooling. If these conditions prevailed, luster effects were developed at any temperature consistent with the glaze composition and stability of the metal involved. The factors involving types and thickness of glazes and the concentration of metal could easily be standardized.

An investigation is being made of effects of crystallization on glaze fit (15).

Research

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CAMBRIDGE GLASS CO., Cambridge, Ohio.
FRANKLIN GLASS CORP., A. L. Pasquier (voter), Box 150, Butler, Pa.
HOLOPHANE CO., INC., Charles Franck (voter), 342 Madison Ave., New York 17, N. Y.
LANCASTER LENS CO., H. G. Crumbaker (voter), 220–226 W. Main St., Lancaster, Ohio.
McKEE GLASS CO., Gerald Terrill (voter), Jeannette, Pa.
REED, F. E., GLASS CO., 860 Maple St., Rochester, N. Y.
SIMMONDS AEROCESSORIES, INC., J. E. D. McCarty (voter), 21-10 49th Ave., Long Island City, N. Y.
*TYGART VALLEY GLASS CO., O. C. Noble (voter), Washington, Pa.
WHEATON, T. C., CO., Frank H. Wheaton, Jr. (voter), 1118 N. High St., Millville, N. J.

Personal

COOK, ROY J., 154 Poplar Ave., West Springfield, Mass.; factory manager, Hampden Grinding Wheel Co.
*DICKENS, H. A., Nilcrom Porcelains (Aust.) Pty. Ltd., 221 Separation St., Northcote, Victoria, Australia.
ESPINOSA, MIGUEL, Export Dept., Owens-Illinois Glass Co., Toledo 1, Ohio (studying glass manufacturing).
FREITAS, LAFAYETTE DE, Industria Brasileira de Artigos Refractarios S/A, Rua Marconi 23 6° andar sala 1 e 2, São Paulo, Brazil.
HESSE, HELEN L., 1017 W. Glenoaks Blvd., Glendale 2, Calif.; teacher.
LYON, LOUIS, JR., Brightwood Rd., Library, Pa.; National Refractories Co.
MAJESKE, JOSEPH, T. C. Wheaton Co., Millville, N. J.
MINNICK, L. JOHN, 306 Boyer Rd., Cheltenham, Pa.; G. & W. H. Corson, Inc.
MOTOCK, GEORGE T., 3100 East 45th St., Cleveland 4, Ohio; Republic Steel Corp.
MOYER, ROBERT E., 234 Mulberry St., Coshocton, Ohio; Moore Enameling & Mfg. Co.
O'BANNON, LORAN S., 1215 Parkway North, Columbus 8, Ohio; Battelle Memorial Institute.
PENZICKES, JOHN, 63 Mulberry St., Springfield, Mass.; research engineer, Hampden Grinding Wheel Co.
RODRIGUEZ E, CARLOS E., Calle de Cuba and Chile 59-1, Medellin, Colombia, South America.
SHORT, ALLAN M., 1710 Missouri Pacific Bldg., St. Louis, Mo.; Missouri Pacific Lines.

Student

Iowa State College: ARTHUR V. PERRY.

* Indicates former member of The Society rejoining.

MEMBERSHIP WORKERS' RECORD

CORPORATION: R. Russell, Jr. 1, R. R. Shively 9, Office 1.
PERSONAL: R. M. Bowman 1, H. B. DuBois and R. Russell, Jr. 2, Jose T. Grageda 1, L. C. Hewitt 1, H. M. Kraner 1, O. E. Mulvane 1, H. J. Rolke 1, R. Russell, Jr. 1, H. Z. Schofield 1, L. Shattuck 1, R. R. Shively 1, Office 2.
STUDENT: C. M. Dodd 1.
GRAND TOTAL: 26

ROSTER CHANGES FOR MAY*

COFFER, L. WALLACE, Climax Molybdenum Co., Langeloth, Pa. (Burgettstown, Pa.)
HOHMANN, FREDERICK R., 712 10th St., Oakmont, Pa. (Marion, Ind.)
LENNON, JOHN W., 303 Highfield Lane, Nutley 10, N. J. (Belleville, N. J.)
LULL, STANLEY E., Sylvania Electric Products, Inc., 126 Washington St., Salem, Mass. (Lake Charles, La.)
McCUTCHEN, EARL S., 1103 E. Washington St., Washington, Iowa (Columbus, Ohio)
NOYES, BRADFORD, P. R. Mallory & Co., Indianapolis, Ind. (Watertown, N. Y.)
ROBINSON, GILBERT C., Church St., Cooleemee, N. C. (Florence, Ala.)
SHOENBERGER, HORACE K., 542 Mahoning St., Lehighton, Pa. (Niagara Falls, N. Y.)
ULRICH, ROBERT J., American Radiator & Standard Sanitary Corp., Litchfield Plant, Litchfield, Ill. (Elyria, Ohio)
WITZEMANN, A. WILLIAM, 265 E. Tulane Rd., Columbus 2, Ohio (Kittanning, Pa.)

* Address in parentheses is former address.

MEMBERS IN SERVICE*

The following members of this Society are in fighting units of war service. There are several in service in Washington not included in this Service Roster. This list, which was begun September, 1942, and added to each succeeding month, is probably not complete, and we would appreciate information on other members.

(276) A. R. BOERNER, General Electric Co., Cleveland, Ohio.
(277) JULIAN T. BROWN, JR., Georgia School of Technology, Atlanta, Ga.
(278) TED H. HARLEY, Ohio State University, Columbus, Ohio.

* These are in addition to the lists published monthly, beginning with the September, 1942, *Bulletin*, with the exception of the June, 1943, issue.

"Seeing Things Under the Bed"

Yes, Sir! We Must Be Vigilant
If We Are to Be Directors of Our Own Destinies
In Business and in Private Affairs

Surely in No Other Way Can There Be Security

Security Must Be Earned
As Well As Preserved

By Research We Will Be Vigilant
Hunting Things even "Under the Bed"

PAID MEMBERSHIP AND SUBSCRIPTION RECORD

Date of Record	Members Paid		Deferred	Subscriptions	Monthly Sales	Total Circulation
	Personal	Corporation				
January 21, 1943	2079	267	11	444	220	3021
February 21, 1943	2095	267	10	451	220	3043
March 21, 1943	1765	262	8	416	220	2671
April 21, 1943	1909	266	18	442	220	2855
May 21, 1943	1931	280	15	438	220	2884
January 21, 1944	2110	323	4	531	220	3188
February 21, 1944	2147	330	4	540	220	3241
March 21, 1944	1844	323	4	523	220	2914
April 21, 1944	1996	344	3	560	220	3123
May 21, 1944	2061	361	4	570	220	3216

CHARLES SIDNEY PEARCE TO JOIN SOCIETY STAFF

Charles Sidney Pearce will enter the employ of The American Ceramic Society as Associate Secretary July 15, 1944. He will be located at the Society's Executive Offices, 2525 N. High St., Columbus, Ohio.

The hiring of Mr. Pearce is a culmination of plans which have been under discussion for four years.

Biography of Charles Sidney Pearce

Charles Sidney Pearce was born at Wichita, Kansas, August 28, 1898. He attended public school in Steubenville, Ohio, and was graduated from high school in 1916.

In 1920, after several years with the Weirton Steel Co., Weirton, W. Va., he entered the Carnegie Institute of Technology at Pittsburgh, Pa. In 1922, he withdrew to attend the Ohio State University, Columbus, Ohio, where he received his bachelor's degree in business administration in 1924.

Charles Sidney Pearce

After two years with the Tennessee Furniture Co., Chattanooga, Tenn., he joined the Delco-Light Co., Dayton, Ohio. This organization later became the Frigidaire Division of the General Motors Corporation. He held various supervisory positions, taking charge of the Porcelain Enameling Department in 1930. This Department, at that time the largest wet-process porcelain enameling plant in the world, consisted of nine continuous furnaces and nine box furnaces with supporting equipment. It normally employed more than 600 men.

In the fall of 1935, Mr. Pearce was appointed assistant director of personnel for the Resettlement Administration with headquarters in Washington and was transferred with this bureau to the U. S. Department of Agriculture.

Early in 1938, he became managing director of the Porcelain Enamel Institute. He will continue in this capacity until assuming his new post.

He is a member of The American Ceramic Society, American Trade Association Executives, the American Management Association, F. & A. M., Lambda Chi Alpha fraternity, and Beta Gamma Sigma.

Publications

(1) "Control of Expense Materials," *Foremen's Mag.*, **4** [12] (1928).

(2) "Accounting for Porcelain Enameled Products: I, III–IV," *Enamelist*, **11** [1] 9–12, 24; [2] 10, 21, 23; [3] 11–12 (1933); **13** [1] 9–10, 58; [2] 18–19, 75; [3] 26–27 (1935); [4] 24–25, 46; [6] 25–26, 56 (1936).

(3) "Improved Cabinet Design Reduces Enamel Chipping," *Steel*, **98** [16] 40, 43 (April 20, 1936).

(4) "Manpower—Most Important Raw Material," *Enamelist*, **13** [8] 25–28 (May, 1936).

(5) "Silicosis—Racket or Responsibility?" *Ceram. Ind.*, **28** [2] 140, 145 (1937).

(6) "Prevention of Silicosis by Improvements of Plant Working Conditions," *ibid.*, [4] 342, 344.

(7) "Silicosis—Legal and Moral Responsibility," *ibid.*, **29** [1] 50, 52 (1937).

(8) "Porcelain Enamel in Nation's Capital," *Enamelist*, **14** [7] 13–15 (April, 1937).

(9) "An Industry Comes of Age," *Metal Progress*, **32** [1] 42–45 (July, 1937).

(10) "Open-Hearth Iron Taps a New Market," *ibid.*, **33** [1] 49–53 (1938).

(11) "Institute and the Plant Man," *Proc. Porcelain Enamel Inst. Forum, Third Forum, Oct., 1938*, pp. 27–31.

(12) "New Markets," *Enamelist*, **16** [5] 10–14 (Feb., 1939).

(13) "Research Program of the Porcelain Enamel Institute," *Bull. Amer. Ceram. Soc.*, **18** [6] 229–31 (1939); reprinted in *Better Enameling*, **10** [6] 19–21 (1939).

(14) "Successful Shipping of Porcelain Enameled Products," *Better Enameling*, **11** [6] 12–13, 27 (1940).

(15) "Training for Porcelain Enameling Industry" (guest editorial), *Enamelist*, **18** [7] 5–6 (April, 1941).

(16) "Porcelain Enamel in War Work," *Bull. Amer. Ceram. Soc.*, **21** [8] 162–64 (1942); reprinted in *Better Enameling*, **13** [5] 13, 16–17 (1942); *Enamelist*, **19** [8] 11–13, 62–63 (May, 1942).

(17) "Our Part in the War," *Enamelist*, **19** [12] 5–6 (Sept., 1942).

(18) "Review of Institute Activity," *Better Enameling*, **14** [3] 2–4 (1943).

(19) "Trip to Fort Knox," *ibid.*, [8] 7–8; *Enamelist*, **20** [11] 19–20, 29 (Aug., 1943).

(20) "Our Peacetime Industry," *Bull. Amer. Ceram. Soc.*, **22** [8] 279–80 (1943).

Mr. Pearce also compiled a Bibliography of Enamels (1930–1937, inclusive) which was published by the Porcelain Enamel Institute.

Each Day Is
D-Day in Ceramics

Only by Sustained Invasion
Can Success Be Had

AUTUMN MEETINGS

Glass Division: Hotel Schenley and Long Vue Country Club, Pittsburgh, Pa., September 13 and 14.

White Wares and Materials and Equipment Divisions: Hotel Summit, Uniontown, Pa., September 15 and 16.

A REPORT FROM THE CHAIRMAN TO MEMBERS OF THE DESIGN DIVISION

A very vigorous and interesting meeting was held in Pittsburgh April 3 to 5. We were delighted with the large attendance with a number of new members present. Everyone was invited to take part in the discussions and many did.

Theodore Lenchner, Vice-Chairman, and I attended the Board of Trustees' meeting Saturday afternoon, April 1, and, after reporting on the status of our membership in the Design Division, we explained our plans for a new committee to be known as the Public Relations Committee. The function of this Committee will be to adopt a broad plan to stress "American" in advertising all ceramic products. A report of one manufacturer was submitted to show his willingness to cooperate with us. Others will be contacted.

Mr. Lenchner and Vincent Broomhall will head this Committee. The Committee plans to publish in the near future in *The Bulletin* of The Society the life story of today's designers, where they work, examples of their work, and their aims. Such men of industry as Thorley, Broomhall, Bacher, Vontury, and many others are all great living contemporary designers of our times—men who have arrived and will inspire you.

Out of the enthusiasm of the Pittsburgh meeting grew a movement to set up at once an Ohio Valley Section of the Design Division, also an Atlantic Coast Section. It is the hope of this group that plans will be taken from what we are doing here in the East by our friends in California and that they will set up a similar movement on the Pacific Coast.

A meeting will shortly be called at Trenton, N. J., to set up plans for the Atlantic Coast Section. A number have expressed their willingness to attend. I called for help at Pittsburgh to man all committees. The slate was completed with Professor Harder heading the Papers and Program Committee. We have three papers lined up for the 1945 Buffalo, N. Y., Meeting. Plan *now* to be with us. Remember the old maxim "You only get out of a Society in direct portion to what you are willing to put into it." There was ample evidence of "Design" thought from the entire program at Pittsburgh. We are only trying to add one more stone upon a splendid foundation of great leaders who by the hand of God are no longer with us.

—WALTER A. WELDON, *Chairman*

PITTSBURGH SECTION

The fourth regular meeting of the Pittsburgh Section for 1944 was held April 2 to 5 with an unusually large attendance of almost 1300, attracting many members from other Local Sections throughout the country as well as our own. The attendance was so large, in fact, that we were obliged to move from our usual quarters into the Hotel William Penn. This annual spring rally which the Section inaugurated last year has proved to be highly successful from the standpoint of attendance and interest shown by the members of the Section and their guests from other Sections.

The fifth regular meeting was held May 9 in the Mellon Institute auditorium, with W. C. Rueckel, Chairman, presiding.

Joshua L. Miner, vice-president of the Atlas Lumnite Cement Company, talked to the group on "Calcium Aluminate and Other Hydraulic Cements."

Commencing with a history of the development of hydraulic cements, the speaker went back to the early Egyptians who used burnt gypsum in masonry construction. Later, the Greeks and Romans made durable masonry through the use of calcined volcanic tuffs. Improvement in the art began in the middle of the 18th century when hydraulic lime was discovered in England through the calcining of argillaceous limestones, this type of cement becoming known later as natural cement.

Artificial or Portland cement dates back to 1824 when the first patent was issued on the calcination product of a pulverized mixture of limestone and clay.

Mr. Miner then discussed the following types of cements, giving a brief historical sketch along with a résumé of manufacture, properties, and present usage: chemical-resistant, high early strength, low heat of reaction, oil-well drilling, air-entraining, natural, masonry, Portland pozzuolan, Portland blast-furnace slag, slag, white Portland, and refractory.

The talk was highly informative and of general interest to the entire group as evidenced by the lively discussion which followed.

This meeting terminated the Section's group activities until September.

—J. W. JORDAN, *Secretary*

NATIONAL ELECTRONICS CONFERENCE

Designed to fulfill the need for providing a common meeting place and discussion forum for technical personnel interested in applications in the broad field of electronics, the first annual National Electronics Conference will be held at the Medinah Club of Chicago, 505 N. Michigan Ave., Chicago, Ill., October 5–7, 1944. The widespread use of electronic developments in the furtherance of this nation's war effort makes this conference of unusual timeliness. Emphasis will be placed on the engineering aspects of electronics in the Conference which is described as a "national forum for electronic developments and their engineering applications."

The Conference is sponsored jointly by the Illinois Institute of Technology, Northwestern University, the Chicago Section of the Institute of Radio Engineers, and the Chicago Section of the American Institute of Electrical Engineers. An excellent program is assured. Technical papers and discussion groups are planned to treat the communication, industrial, measurement, instrumentation, control, scientific, and medical applications of electronics. As one means of furthering the war effort, particular attention is being given to the needs of many industrial engineers who have used electronic methods in rather restricted and specialized applications. One session will be devoted to educational problems and an electronic curriculum for technical schools and colleges.

Those wishing to submit papers for presentation at the Conference are invited to communicate with Professor A. B. Bronwell, Chairman of the Program Committee, Technological Institute, Northwestern University, Evanston, Ill., or Mr. Beverly Dudley, Secretary, National Electronics Conference, 520 N. Michigan Ave., Chicago 11, Ill.

GEORGE WESTINGHOUSE SCHOLARSHIP WINNERS ANNOUNCED

Ten George Westinghouse scholarships, each valued at $1850, have been awarded to top-ranking seniors in high schools from coast to coast. The winners are attending the College of Engineering of the Carnegie Institute of Technology, Pittsburgh, Pa.

The selections were made from among 684 candidates in the seventh annual scholarship competition sponsored by the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa. Examinations were held March 4. Recipients of the awards were chosen on the basis of mental ability, aptitude for engineering, and qualities of leadership and personality.

Scholarships for winners who enter the armed services will be held until they return.

Successful candidates were George Baldwin, New Canaan, Conn., New Canaan High School; Richard Eschenbach, Williamsport, Pa., Williamsport Senior High School; Clifford H. Gower, Austin, Minn., Austin High School (second winner from Austin High); Thomas J. Hall, Kenton, Ohio, Kenton High School; Warrent D. Helmer, Jr., Spokane, Wash., John R. Rogers High School; Richard T. Huntoon, Detroit, Mich., Cooley High School; F. Vincent Prus, Baden, Pa., Ambridge High School, Ambridge, Pa.; Chandler L. Sammons, LaGrange, Ill., Lyons Township High School; Clark Sloan, Jr., Nashville, Tenn., West End High School; and Dale Wright, Amarillo, Tex., Amarillo High School.

All of the aspiring engineers except one are seventeen years old; one is sixteen.

The ten winners were picked from high-school seniors from forty-four states and the District of Columbia. All of the states were represented except Arizona, New Mexico, Nevada, and Mississippi. The scholarship quizzes were given at 157 test stations throughout the country.

The tests covered "I.Q.," natural sciences, and mathematics. Results showed that the group scored well within the top standards set for these tests by the country's outstanding colleges and universities.

Questions asked the high-school candidates ranged from simple word associations to problems in solid geometry and trigonometry. They ranged in difficulty from those a bright high-school student should know to those planned to stump college seniors.

The scholarships were originally designed to extend over a "work-learn" period of sixty months, but they are now keyed to the accelerated wartime curricula at the Carnegie Institute of Technology, which permits qualifying for an engineering degree in thirty-two months of intensive study.

The original program, and the one which will again be adopted after the war, provided for four years at Carnegie Tech and four summers and one full year in the shops and laboratories of Westinghouse. There is no obligation to join the Company after the completion of the course.

The work assignments at Westinghouse have been suspended for the duration of the war so that the scholarship students may complete their university program at the earliest possible date and take their places in industry or the armed forces.

The 1944 scholarship winners started their classes June 5.

Four of the winners have elected to pursue electrical engineering careers. The remainder will concentrate on chemical engineering.

UNITED STATES SECTION OF PAN AMERICAN INSTITUTE OF MINING ENGINEERING AND GEOLOGY FORMED

The First Pan American Congress of Mining Engineering and Geology, organized and directed by the Institute of Mining Engineering of Chile and officially authorized by the Government of Chile and the South American Union of Engineering Associations, was held in Santiago, Chile, January 15 to 23, 1942. The American Institute of Mining and Metallurgical Engineers appointed several delegates to this Congress, including Edward Steidle and Will Wright. Mr. Wright was selected to head the group and prepared the report on the meetings which was published in *Mining and Metallurgy* of March, 1942. Our Government appointed D. F. Hewett to represent the Geological Survey, Elmer Pehrson the U. S. Bureau of Mines, and Will Wright the State Department. Edward Steidle represented the Commonwealth of Pennsylvania.

At this Congress, it was decided to organize a Pan American Institute of Mining Engineering and Geology (P.A.I.M.E.G.) with headquarters in Santiago, Chile. National sections have been organized in Argentina, Bolivia, Brazil, Chile, Peru, and Uruguay. This organization naturally wanted the support of A.I.M.M.E., and at the February meeting (1943) at a meeting of the Board, Mr. Albala, the General Secretary of P.A.I.M.E.G., discussed the object of the organization and their desire for A.I.M.M.E. support. Dr. Mathewson, president, selected a committee to study the matter and after various discussions with the committee as to just what A.I.M.M.E. would and could do, the decisions were finally published in the December, 1943, issue of *Mining and Metallurgy*.

The first Congress embraced fourteen sections, representing every branch of the mineral industries. Perhaps the most important result of the Congress was the mutual recognition by the representatives of all nations that the Americas face a common problem of defense in the present emergency and possibly even more serious social and economic readjustments in the postwar years. Recommendations, therefore, were made by resolution of the Congress with the intention of establishing good-neighbor policies with respect to minerals on a firm basis.

P.A.I.M.E.G. desires to cooperate with all the mineral industries societies of the Americas, support all activities that will benefit the mineral industries, and expand fundamental knowledge of geological conditions and encourage the standardization of technical terminology. The Institute will also facilitate the interchange of publications, students, professional men, and industrialists connected with the mineral industries.

An annual meeting of the members of P.A.I.M.E.G. will be held in conjunction with that of the February meeting of A.I.M.M.E. in New York, and a program of papers will be presented on mining, metallurgical, and geological subjects in Latin American countries.

P.A.I.M.E.G. is proposed as an autonomous private institution independent of the governments of the Americas. Qualified candidates from commercial organizations, societies, universities, etc., which are closely related to the mineral industries are accepted as members. P.A.I.M.E.G. wishes to organize through the initiative of individuals and private interests without having the necessity, for the time being, of asking help of the governments concerned.

At the annual A.I.M.M.E. meeting in February, Mr. Wright met with President Mathewson, Secretary Parsons, Edward Steidle, and D. F. Hewett to discuss the possibilities of organizing a national section of P.A.I.M.E.G. in the United States. At Mr. Parsons' suggestion, it was decided to hold an initial meeting in New York April 19, at the time of the regular A.I.M.M.E. Board meeting. Edward Steidle was asked to serve as chairman of the Steering Committee in accordance with a request from President Rodriguez, P.A.I.M.E.G., under date of November 10,

1943. A second Congress is scheduled to be held in Rio de Janeiro, Brazil, in October, 1944, but will no doubt be postponed for the duration. Future Congresses will be sponsored by P.A.I.M.E.G.

Chairman Steidle invited seventy men, principally of New York and Washington, who have had some personal contact with the Latin Americas, to attend a Steering Committee meeting in New York April 17. He received forty-eight acknowledgments, of which thirty-eight offered to join immediately. Seven additional men sent word indirectly that they would join. Eighteen men reported for the Steering Committee meeting.

The consensus of the Steering Committee was that it was most desirable that a National Section of P.A.I.M.E.G. be formed in the United States without further delay. A motion establishing the Section was carried unanimously. Upon proper nomination and vote, the following were elected as a National Directorate:

Chairman: EDWARD STEIDLE, Dean, School of Mineral Industries, The Pennsylvania State College.
Vice-Chairman: C. W. WRIGHT, Chief Foreign Minerals Specialist, U. S. Bureau of Mines.
Secretary-Treasurer: A. T. WARD, Mining Engineer, New York City.
Directors: D. F. HEWETT, in charge, Section of Metalliferous Deposits, U. S. Bureau of Mines; M. B. GENTRY, Vice-President, Freeport Sulphur Co., New York City; T. T. READ, School of Mines, Columbia University; and W. E. MILLIGAN, Department of Metallurgy, Yale University.

Members of any mineral industries society in the United States and Canada are eligible to join the National Section. Individuals paying 1944 dues, amounting to $5 (no initiation fee), before December 31, 1944, will be recorded as Charter Members. The Chairman was requested to make this known to interested people through the medium of the various publications in the field of the mineral industries, including societies and other technical organizations. At this stage, membership must be based on willingness to aid in fostering good will and better understanding among mineral industries engineers and technologists in the Western Hemisphere. Anyone interested in joining P.A.I.M.E.G. as a charter member is requested to forward dues to Edward Steidle, Chairman, National Directorate, P.A.I.M.E.G., State College, Pa., or to Arthur T. Ward, Secretary-Treasurer, National Directorate, P.A.I.M.E.G., 50 Church St., New York, N. Y. Minutes of the organization meeting will be forwarded to all members.

POSTWAR CERAMIC CONSTRUCTION*

BY HERBERT V. KAEPPEL†

The Goal: Two Million Homes a Year!

You have heard many talks of great importance today. I should like to draw your attention to three statements in three of these talks that affect all of you vitally.

Mr. Clark of the Westinghouse Better Homes Department stated that we would build approximately ten million homes in the first ten years after the war. A few minutes ago, you saw the movie "March of Time," in which Paul G. Hoffman, chairman of the Committee for Economic Development, said that we must produce 40% more goods than in 1940. James Lincoln of The Lincoln Electric Company stressed the importance of producing at a price that will make your market as great as you wish.

These three statements are interrelated. Ten million homes or ten million of any product can be sold only at a price which the ten million persons who buy these products can afford. As production men, it is your job to produce these products at a cost that makes it possible to realize the markets Mr. Hoffman mentioned.

The statement, "building ten million homes," rolls easily off the tongue. Several years ago, the aim was 750,000 homes a year. It gradually increased to one million and reached the million and a half mark about six months ago. The latest figure is two million homes a year.

Two million homes a year are possible if they can be produced at a price. Approximately six million homes were built in the twenties; in that decade, however, we were aiming at a $10,000 house. In the Victory Decade, we are "shooting at" a $5000 house. We will try to make that house just as good as the $10,000 house of the twenties. Obviously, you must do something about the cost of the products which go into that house to reduce the price to $5000. This means lower-cost ceramics.

By a low-cost house, I do not mean a prefabricated house, the miracle, the dream home that the Sunday supplements have exploited and expounded on.

In our organization, we publish several papers in the building field; our magazine, *Practical Builder*, particularly, has engaged in extensive research work on prefabrication and the postwar home. Our ceramic industries staff collaborated in this research because of the ceramic-product phase.

We do not believe in prefabrication to the extent to which it has been talked about, but there undoubtedly will be some. Mr. Clark stated that, by and large, products will be about the same in the postwar years as in the prewar years with the natural evolution that comes. The $5000 house must be considerably different in many ways from the house in which most of us live if ten million homes are to be built. The average age of homes in America is about twenty-five years.

Role of Lower-Cost Ceramics in the Postwar Home

Ceramic products will play a great part in the development of a design for better living. You will be called upon to produce parts of this house at a lower cost.

Glass

Plate glass, glass blocks, glass wool insulation, glass fiber textiles, etc., will be used extensively in the new home.

Window glass will quickly double its use. Some tremendous developments have taken place not only in the type of windows, with double glazing, built into the sash, and sealed, but new things have been discovered about windows themselves.

In Chicago, George Fred Keck, an architect, and H. M.

* Extemporaneous address given at the Forty-Sixth Annual Meeting, The American Ceramic Society, Pittsburgh, Pa., April 3, 1944 (War Conference General Session). Received May 3, 1944.

† Executive editor, *Ceramic Industry* and *Brick & Clay Record*, Chicago, Ill.

Sloan, a builder with the Libbey-Owens-Ford Glass Company, experimented with solar radiation, which has been tremendously successful with whole wall areas built of glass.* In addition to using the sun's rays for heating, they have found that the restfulness of areas which bring the outdoors into the house through the medium of wide expanses of windows is tremendously beneficial. The eye is normally at rest when focused on an object fifteen feet away. Small windows produce a glare, yet large window areas do not because they increase the light in the room to such an extent that the eye is not subject to the sudden readjustment which a small window imposes by reason of the dark wall areas surrounding it.

Windows have another significance which will interest the manufacturers who, although indirectly concerned with home products, nevertheless manufacture products which go into the home, such as dinnerware and glassware.

Just before the war, when building stopped, the Colonial type of home had a renaissance and became the most popular type of home. The Cape Cod type of home stood out as the number one choice of the American people. Investigations lead us to believe that this peak has passed. The development of windows will influence profoundly the architecture of the postwar home. After all, if you want large window areas, with their attendant benefits—windows that extend from the floor to the ceiling, not simply windows a few square feet larger than the ones you now have—can you stretch a Cape Cod home out of shape to have them? You soon reach the point where you discard the Cape Cod entirely and look for a type of house that will lend itself to the large window and has an interior plan which will give you the kind of living you want. We therefore may well watch the trend toward modern architecture, not the modernistic, flat-roof overhanging-bedroom, cubical type of architecture, but the attractive American modern home of which there are an increasing number of examples.

When we accept this kind of design, it is not hard to imagine that that same desire, that same appreciation for something different, will extend into glassware and artware, furniture, and dishes. Perhaps it is presumptuous of me to suggest, but I cannot refrain from stating that the glassware and dinnerware manufacturers and the artware designers should keep this in mind. The American public will undoubtedly respond to a style trend that will fit this new modern home.

Sanitary Ware and Kitchen Appliances

The builders of the country are thinking not only in terms of a modern bath but of more bathroom facilities. The smallest home must have additional facilities, at least to the extent of an extra fixture. The medium-priced home should have at least a bath and a half and the higher-priced homes two or two and a half. This presents a great, new opportunity for the sale of ceramics in the postwar home, but again the sale depends largely upon the price at which these articles can be produced.

Effect of Plastics

In our investigation of the postwar home, we also looked carefully into such new products as plastics. We went not only to the ceramic people to find out whether they were worried about plastics but to the plastic manufacturers themselves. Perhaps some of you have read the recent articles in *Ceramic Industry* on plastics and their possible competition with ceramics. Little hope is held for the use of plastics in sanitary ware and in kitchen appliances such as refrigerators, stoves, etc. Our information came largely from the plastics manufacturers.

In March, 1944, a conference on postwar housing held in Chicago was attended by 600 leaders in the building industry. On the program was a plastics consultant who had no interest in any particular kind of plastics. He presented one of the most conservative speeches on plastics I have ever heard.

Plastics will be used, but they will not compete seriously with ceramics if we do the necessary research work on our products and in our plants and keep our prices in line with those the producers of homes can afford.

Prefabrication

At this same housing conference, Henry Kaiser gave an interesting address. About a year ago, he received considerable publicity on a statement to the effect that he was going to prefabricate a $1500 home out of steel. In his most recent statement on prefabrication, however, he said that prefabrication would account for approximately 5% of the homes in the first five years after the war. He spoke particularly of the bathroom. He imagined that sometime a designer would be paid as much as $30,000 to design a bathroom. A bathroom can be prefabricated or partially prefabricated and a kitchen may be prefabricated or partially so in sections. New types of fixtures could be designed which would lend themselves to prefabrication.

A prefabricated bathroom was built in California eighteen months ago. It was not successful, yet the conservative manufacturers in the building industry are leaning more and more toward the partial prefabrication of large sections of the house, such as bathrooms and kitchens.

Electrical Porcelain

If I were an electrical porcelain manufacturer, I would be much interested in some statements and statistics that have been published recently on the amount of electricity used by the average home. In 1926, the average consumption of electricity per home was approximately 400 kilowatt-hours. Just before the war, the consumption had been increased to about 1000 kilowatts. Mr. Clark, speaking at a recent luncheon, pointed out that the near-future potential for the home is 10,000 kilowatts. When I attempted to pin him down to the amount the average small home would use, we more or less agreed that it would be approximately 3000 kilowatts within probably five years after the war.

The builders of homes throughout the country in planning new homes are allowing for a great increase in the use of electrical energy. Suppose the 3000 kilowatt-hour figure is too high and we go only to 2000. This would mean an enormous expansion of public utilities throughout the country, an increase in the amount and number of electrical appliances, and a vast new market for electrical porcelains for the production of the extra electricity.

* See also "Glass after the War" by Alexander Silverman, *Bull. Amer. Ceram. Soc.*, **22** [7] 217–22 (1943).

Porcelain Enamel

As I said a moment ago, the enamel manufacturers do not have to worry about plastics. On the other hand, there are enormous new opportunities for markets for this industry. At least two new products in themselves have probably as large a potential as any present single market of porcelain enamel, viz., chimney flues and water tanks.

A porcelain enamel chimney has been tested, is practical, and has certain advantages over masonry. It heats up more quickly, is more efficient, and is entirely fireproof. It may be placed anywhere in the house, hung from the studding, without any foundation. Assuming an average of 50 feet per house, a million houses would use 50 million feet of porcelain enamel flues.

The water-tank problem could have been licked before the war but it sometimes requires something as drastic as a war to force the development of a product which encompasses a great many serious production difficulties, but with the aid of the recently established Porcelain Enamel Water Tank Association the problem has now been solved.

If you can picture 30 million water tanks in the United States now rusting away and deteriorating, plus the million homes a year we are going to build, it does not take much imagination to picture a rather large market for porcelain enamel in that field alone.

Heavy Clay Products

Structural clay products have a great opportunity in the postwar field.

The secondary phase of the construction market, i.e., buildings that follow home construction, such as schools, churches, civic buildings, small factories, and small commercial buildings, was just beginning before the war. It was cut off by restrictions, but will resume immediately after the war. There is no substitute for masonry in these types of buildings. The steel manufacturers do not expect to build apartment houses, churches, and schools. The plastic manufacturers will not pour a plastic or molded wall. These buildings must be made of clay products because there is nothing else.

In homes, also, some manufacturers have shown great initiative in developing new opportunities for the sale of clay products. Southern manufacturers, for example, have been extremely successful in capitalizing on the tendency toward a basementless house by developing a hollow tile and concrete floor construction, an economical construction which carries within it sufficient insulating qualities to provide a warm floor. It takes care of practically all of the problems that attend the building of a house without a basement.

In certain areas and under certain conditions where large lot sizes and land areas permit stretching a house out over the surface, more houses will be built without basements. In the cities, there is no place to go but up and three-story houses are not very practical, so we will continue to go down into the ground for needed space.

In Chicago about a year ago, a house was built with hollow tile floors which were used as a heating unit. Hot air was circulated throughout the floor, the cells in the tile used as flues providing a radiant heating principle similar to that used when hot-water pipes are embedded in a concrete floor. When investigated recently, the installation proved to be entirely practical and successful. Here again is an opportunity for the structural clay products manufacturers of which they will undoubtedly take advantage.

An architect dropped into our office recently to discuss the possibility of glazed tile units. Manufacturers designing new factories seem to be seriously thinking in terms of the economy of upkeep, sanitation, etc. They have found that glazed tile and brick units are more economical and cost less from an operating standpoint than the conventional structural materials with which factories have been built.

Conclusion

Much more could be said about the postwar home and building program, but perhaps in this brief discussion I have given you some idea of the importance of your job, the job of keeping your products in line with the cost which builders must reach to attain the goal of two million homes a year.

INDUSTRY PREPARES FOR PEACE*

By K. G. Fuller†

I. Introduction

There have been so many discussions, papers, and arguments about postwar plans that to save time I have introduced my subject today by showing you a movie, soon to be released by the March of Time, which outlines briefly the general problem of postwar planning. This problem can be divided into three phases, (1) nationwide planning, (2) individual regional and city planning, and (3) individual company planning.

II. Organization and Methods of CED

In the autumn of 1942, Paul G. Hoffman, president of the Studebaker Corporation, Jesse Jones, and several others discussed the first two phases of this problem. The Committee for Economic Development was the outgrowth of their discussions. This Committee is headed by a board of trustees which includes Paul G. Hoffman, chairman; Chester Davis of the Federal Reserve Bank of St. Louis; C. F. Kettering of the General Motors Corporation; Eric Johnston, president of the U. S. Chamber of Commerce; Charles R. Hook, president of the American Rolling Mill Company; and men of like caliber.

* Presented at the Forty-Sixth Annual Meeting, The American Ceramic Society, Inc., Pittsburgh, Pa., April 3, 1944 (War Conference General Session). Received May 13,1944.

† Manager, Market Research and Sales Promotion, United States Steel Corporation of Delaware, Pittsburgh, Pa., and chairman, Research Committee for Southwestern Pennsylvania of the Committee for Economic Development.

Under this board of trustees are two groups, one of which is the Research Division under the chairmanship of Ralph Flanders, president of the Jones & Lamson Machine Company, which includes Beardsley Ruml of Macy's, Thomas Lamont of J. P. Morgan, William Batt of SKF Industries, and others. This Division, concerned with research problems for the country as a whole, is trying to improve the economic climate under which all businesses operate. They are analyzing and recommending legislation for such problems as the disposal of Government-owned plants and material surpluses; settlement of war contracts; changes in the tax structure which will help business provide jobs; postwar problems of international trade and finance; and special problems of small business.

CED is particularly interested in problems of small business because it makes up the backbone of our country. If CED can help small business, it will accomplish one of its most important jobs, as, in general, large industries usually have adequate planning staffs of their own. To aid the Research Division, there is a Research Advisory Committee headed by Sumner Slichter of Harvard University and Theodore Yntema of the University of Chicago who are performing the necessary research.

The other group under the national board of trustees, and the one interested in individual regional and city planning, is the Field Development Division headed by Marion Folsom, treasurer of the Eastman Kodak Company. It is the purpose and job of this Division to organize and stimulate postwar planning activities in the communities and individual businesses throughout the country.

To facilitate this, the country is divided into twelve regions, roughly paralleling the Federal Reserve Districts. We in Pittsburgh are in the region which includes Pennsylvania, New Jersey, and Delaware. It is headed in Philadelphia by Walter Fuller, president of the Curtis Publishing Company. At the next level in the organization come the district groups. The Southwestern Pennsylvania district, which includes Pittsburgh, is headed by Harry Wherrett, chairman of the Pittsburgh Plate Glass Company. At still another level, these districts are further divided into county and even smaller community groups, thus enabling CED to reach the individual community level where these groups can do the basic job of stimulating company-by-company postwar planning.

CED will not do any actual planning; its only plan is to disseminate information that will stimulate individual company planning.

III. Individual Company Problems

In the solution of such broad problems as taxation, Government-owned plants, etc., there is little which the individual company can do. Their solution is the proper study of such groups as the National Association of Manufacturers, the Chamber of Commerce, and, of course, CED's Research Division. The individual company can, however, make its own plans for the future and try to weigh the trends which it believes will affect each individual company. The figures which you saw on the screen of so many million refrigerators to be manufactured and so many homes to be built in the first five or ten years after the war are just figures; to obtain its share of that market, the individual company must secure participation in the market in an intelligently planned fashion. There are various ways to do this. The poorest way is to assume that you will get a certain percentage of that market just because you had such a percentage participation in the past.

A better way is first to find out where you stand from an area, customer, industry, and product participation standpoint and then go back to your own sales and engineering organizations and find out from them more about the market and the steps which should be taken to improve your position. You must take such steps as appraising the effect of limitation orders on your products, how many of them have not been on the market since the war, and what products are worn out.

You also must think about the changed habits of the people. Millions of men in the service are living in many different parts of the world. As a result, they may, and probably will, have different viewpoints toward housing. They may, and probably will, have different viewpoints toward food, because they have been eating different types of food than at home. These changed factors in living habits must be recognized in our planning.

In your own consideration of plans for peace, you must delve as carefully as you can into the facts available in your own organization, in Government, local, and trade association reports, and through your own American Ceramic Society. With this type of approach, using facts rather than hopes and wishes, we can all do a better job when peace comes.

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AN ACCOUNT OF THE FIRST BRICKMAKING MACHINE

By Colin Johnston Robb

Belfast, the capital of Northern Ireland, is truly a clay-built city, and as Thackeray said of its buildings, "they have no attempt at ornament for the most part, but are grave, stout, red-brick edifices, laid out at four angles in orderly streets and squares."

It was in this city that one of the first brickmaking machines on record was set up in 1660. The following account of this old machine in modern English orthography taken from a manuscript written by the inventor in my possession may be of interest to brickmakers. It reads as follows:

"On my brick field in this Town I have set up an engine to make brick in hundreds better than made by hand. I have first a chamber made of wood in broad boards caged to hold four yards in the cube of clay in putty. From this a flume is taken to a great pallette board to contain twenty-four full-size brick. To make these, the board is divided into cells with wood the depth of a brick as in moulds to come asunder. These moulds are done in hog's lard before the clay is run to keep the wood from sticking. To make the brick, I puddle the clay in the chamber to run like thick lime in putty. Then I lift the sluice and run the clay in the pallettes and when the moulds are filled they are struck off level and another set of pallettes set to take the next run. With the pallettes sets now working, I can make forty-eight dozen brick in a day, all true in size as from a die. The green brick should be dried for from eight to fourteen days before burning. I improve the clay by hand picking out all the stones even small as they burst under fire. My new brick engine will make the brick more quickly than ever before.

Robert Dowglas, *Brickmaker*

Belfast 1st, May 1660."

This old brickmaker was made a freeman of Belfast on the 17th December, 1663. He may be regarded as the pioneer of the brickmaking machine.

Drumharriff Lodge
Loughgall
County Armagh, Ireland

SYNTHETIC OPTICAL CRYSTALS

Synopsis of booklet published recently by the Harshaw Chemical Co., Cleveland, Ohio.

Harshaw-grown synthetic optical crystals have greatly expanded the field in both infrared and ultraviolet optics. The optical limitations of natural rock salt, sylvine, fluorite, calcite, etc., have been largely overcome by making available synthetic sodium chloride, potassium bromide, lithium fluoride, and sodium nitrate. These crystals are grown from their molten salts, and perfect single crystals up to 35 lb. (16 kg.) in weight are produced. The synthetic optical sodium chloride crystal, for instance, is far superior to natural rock salt. The others are new.

The infrared range up to 25 microns can be effectively covered by using lithium fluoride, sodium chloride, and potassium bromide optics, each in turn giving a high dispersion in its effective range. The production control of high octane motor fuel, synthetic rubber intermediates, and related products has been revolutionized by the use of infrared spectroscopy using Harshaw synthetic optical crystals.

The substitution of lithium fluoride optics for our rapidly diminishing supply of natural optical fluorite is filling a long-required need in the ultraviolet field.

Natural calcite of optical quality is scarce, and the increasing demand for polarizing optics has stimulated research to produce large single crystals of sodium nitrate. The development of other halide crystals to augment the present Harshaw line is contemplated.

(1944)

All Harshaw synthetic optical crystals are single and of optical clarity. Each crystal is grown as a cylinder topped with a 90° cone. The over-all height from the base to the tip of the cone is about 250 mm.; the cylindrical part from the base to the shoulder about 150 mm.; the diameter 190 mm.; and the optically clear portion of the cylinder from 100 to 120 mm. tall.

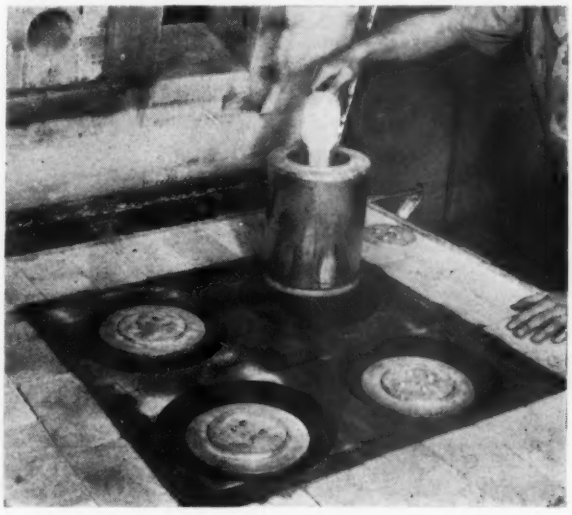

Fig. 1

The principal use of Harshaw synthetic optical crystals has been for prisms, windows, and cells in infrared spectroscopy. These crystals, much larger and more optically perfect than those found in nature, have enabled physicists to design infrared spectrographs with a precision and performance record not previously considered possible. Prisms made from Harshaw synthetic crystals are the resolving elements which make present-day infrared spectrometers possible.

Fig. 2

Growing the Crystals

Large single crystals of sodium chloride, potassium bromide, and lithium fluoride, weighing up to 33 lb. each, are grown in either single-crucible furnaces or in large multiple-crucible furnaces. Growing the crystals is a continuous process, and both the temperature and the mechanical lowering of crystals during growth are under complete control.

Platinum crucibles at the top of a crystallizing furnace are loaded with salt (see Fig. 1). When the crystal is completely grown, it is transferred in the crucible to the melting-out furnace (see Figs. 2 and 3). In the melting-out process, the furnace temperature is raised until the

FIG. 3

crystal is dropped from the crucible (similar to the removal of ice cubes from a refrigerator tray). The red-hot single crystal is then quickly transferred to the annealing furnace and is slowly cooled over a period of one week.

After cooling, the rock salt crystals are cleaved as shown in Fig. 4. Figure 5 shows cleaved window blanks and prisms and lens blanks ready for polishing.

Used platinum crucibles, although battered and scarred, must be carefully reconditioned. They are reshaped on a steel mandrel, patched if necessary, and repolished inside and out.

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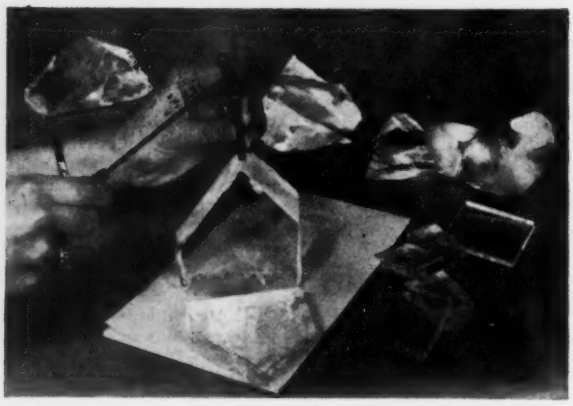

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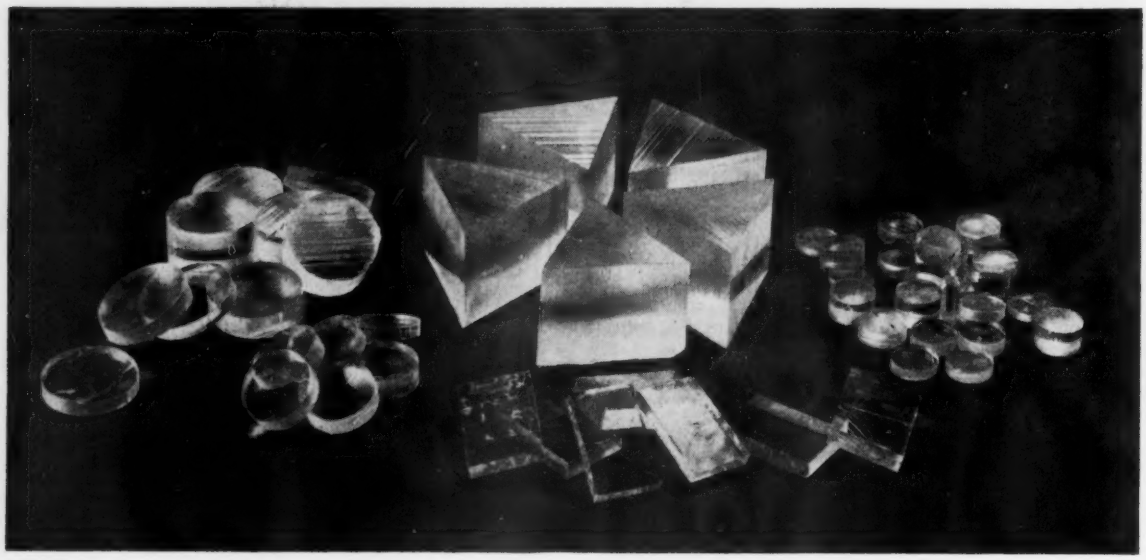

FIG. 5

H. J. ROSE IN NEW POST

Bituminous Coal Research, Inc., has announced the election of H. J. Rose, of Mellon Institute, Pittsburgh, Pa., as vice-president and director of research in charge of the expanded investigational and developmental program of the bituminous coal industry. This organization of coal operators, associations, and railroads in the Appalachian and mid-continent coal fields is enlarging its research projects on coal production and utilization to meet war-time problems and to prepare for and strengthen the industry's postwar position. More than two million dollars will be invested in this research program during the next five years.

Harold J. Rose

Dr. Rose has had extensive experience in the technical and administrative phases of coal research. Starting with the Koppers Company in 1918, he became assistant director of research of that organization. He has been with the anthracite industry since 1932 and is resigning as vice-president in charge of research of Anthracite Industries, Inc., New York, N. Y., to accept the new position. In assuming direction of the broader domain of bituminous coal research, he is returning to his original field of activity. He has been associated with Mellon Institute throughout his professional career.

Dr. Rose is the author of many scientific papers on bituminous coal, coke gas, chemical by-products, and anthracite and has been granted a number of patents. He is a member of the National Fuel Efficiency Council and of the OPA Stove Industry Advisory Council and has been chairman of many national committees of engineering and allied chemical societies. He is a native of South Dakota and was educated at Yankton College, the University of Chicago, and the Carnegie Institute of Technology. He holds the degree of doctor of science and in 1928 received the Grasselli Medal of the Society of Chemical Industry.

(1944)

H. R. WINKLE ADVANCED

Harry R. Winkle, comptroller and treasurer of the Owens-Corning Fiberglas Corp., Toledo, Ohio, has been elevated to the post of vice-president. This action was taken at a recent meeting of the corporation's board of directors in recognition of "the increased importance of the fina ıcial phase of the business."

Harry R. Winkle

Mr. Winkle will continue to serve as comptroller and treasurer, a post he has held since the Fiberglas Corporation was formed November 1, 1938. He has been associated with Owens-Corning and predecessor companies since 1923.

Mr. Winkle is a member of the board of directors of the Fiberglas Corporation, whose general offices are in Toledo, Ohio, and is a member of the National Association of Cost Accountants. He is a native of Lima, Ohio.

SUMMER MEETINGS HELD

Upstate New York Section

Dinner meeting May 26, 1944, at the Hotel Baron Steuben, Corning, N. Y. James Bailey spoke on plastics.

Ohio Ceramic Industries Association

Annual spring meeting June 9, 1944, at the Granville Inn, Granville, Ohio. A technical session in the forenoon consisted of the showing of a film on the history of thermal insulation and papers presented by John Marquis, J. W. Hepplewhite, G. A. Loomis, and George Wilson. A golf tournament was held in the afternoon.

DIVISION AUTUMN MEETINGS

Glass–September 13–14

White Wares and Materials and Equipment—September 15–16

NECROLOGY

WINSLOW HOBART HERSCHEL

Winslow Hobart Herschel, a member of The American Ceramic Society for the past three years, died March 7, 1944, in Baltimore, Md., following a long illness. His home was in Chevy Chase, Md.

Born in West Roxbury, Mass., August 28, 1873, Mr. Herschel was the son of the late Clemens Herschel, an internationally famous hydraulic engineer known particularly as the inventor of the Venturi meter, and Grace Hobart Herschel, daughter of Aaron Hobart, member of Congress from the State of Massachusetts.

Mr. Herschel attended the Roxbury Latin School and in 1896 received the A.B. degree cum laude from Harvard University, Cambridge, Mass. He later studied in Switzerland.

In 1896, Mr. Herschel became associated with the East Jersey Water Company and the Allis-Chalmers Manufacturing Company as hydraulic engineer, and from 1905 to 1910 he was in charge of steam turbine design at the Providence, R. I., Engineering Works. From 1911 to 1913, he was assistant professor and associate professor of mechanical engineering at the University of Maine, Orono, Me.

In 1913, Mr. Herschel became associated with the National Bureau of Standards, Washington, D. C., as assistant physicist and was advanced to associate physicist in 1918. In 1936, he became associate materials engineer in the Clay and Silicate Products Division and held this position until his retirement in September, 1943.

In addition to his membership in The American Ceramic Society, Mr. Herschel held membership in the American Society for Testing Materials, the American Society of Mechanical Engineers, the Society of Automotive Engineers, the American Association for the Advancement of Science (Fellow), the American Chemical Society, the Washington Society of Engineers, the Society of Rheology (vice-president 1929–1931), the Cosmos Club, the Washington Harvard Club, and All Souls' Church (Unitarian). He was particularly active on A.S.T.M. Committee D–2 and developed standard methods of test for the emulsification and friction properties of oils.

Mr. Herschel is survived by his widow, Cornelia Feuerlein Herschel, whom he married in 1906, and a son, Kenelm W. Herschel, a captain in the U. S. Marine Corps stationed in California.

Publications

A partial list of Mr. Herschel's publications follows:

(1) "Quantitative Test for Resistance of Lubricating Oils to Emulsification," *Proc. Amer. Soc. Testing Materials*, **16**, 248–72 (1916).

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BENJAMIN LEROY MILLER*

Benjamin LeRoy Miller, professor of geology at Lehigh University, Bethlehem, Pa., died March 23, 1944, following a heart attack. He would have been seventy years old in April.

An internationally known geologist, Dr. Miller was recognized as a foremost authority on mineral deposits in South America and his book of that title has long been considered a classic. For thirty years he had assisted in many state and federal geological surveys.

Dr. Miller was born in Sabetha, Kans., in 1874, the son of the late Jacob and Mary Moorhead Miller. He had been teaching at Lehigh since 1907, although last September he was granted a leave of absence to do some teaching

* Biographical material and editorial from *The Morning Call*, Allentown, Pa., March 24, 1944.

at Princeton. He recently returned to the campus to continue his writing and had been looking forward to retirement in April.

In an advisory capacity, he had been working with Army Intelligence and various governmental bureaus which are studying natural resources of enemy countries. Dr. Miller spent years in Germany and other European countries and visited Japan many times, the last about 1937 when the Japanese prohibited him from taking pictures of their coal mines and other mineral resources.

Traveling as a mineralogist, Dr. Miller had been all over the world. In 1937, he circled the globe again, attending the International Geological Congress in Russia and returning via China and Japan.

He received his bachelor's degree from the University of Kansas and his doctorate from Johns Hopkins University in 1903. The Moravian College gave him the honorary degree of doctor of science in 1941. Before coming to Lehigh in 1907 he taught at Bryn Mawr, Penn College, Iowa, Kansas University, and the public schools in his native state.

Benjamin LeRoy Miller

His geological work took him over most of the United States, on foot, and in addition to his studies abroad, including Spain and Morocco, he had made extensive geological studies in South and Central America. He mapped the geological formations of the Lehigh Valley with respect to developed and as yet undeveloped economic geological resources; was much sought as consultant in geological and meteorological problems; served many cement companies in connection with quarrying problems; and had helped many industries in mining of limestone, clay, and other rock and mineral products.

Municipalities and states as well as industries often took their water and other problems to Dr. Miller. One of his functions, as a consulting geologist, was to discourage the useless expenditure of money on "forlorn hopes," such as the recovery of oil and gold in areas where such recovery would be unprofitable.

His greatest services, however, were probably rendered in the Bethlehem region. He undoubtedly knew more about the hills, valleys, and rocks of the Lehigh Valley than any other person, and his information was put to use in numberless ways. One of these was the geologic work which he did for the Wild Creek Dam and aqueduct of the new Bethlehem water-supply system.

Dr. Miller was a member of the American Association for the Advancement of Science, the Geological Society of America, the American Institute of Mining Engineers, the American Association of University Professors, the Society of Economic Geologists, the Geological Society of London, Tau Beta Pi, Sigma Xi, and other learned societies. He also was a Bethlehem Rotarian and a member of the Society of Friends and the Torch Club.

Dr. Miller was the author of many books and papers. His early interest in geology was inspired by his grandmother when he was eight years old. Together they collected fossils of prehistoric life and studied the living animals and plants in the hills of Kansas.

(1944)

EDITORIAL TESTIMONIAL

Ever since 1904, Dr. Miller had been on the campus of Lehigh University. The home-coming "old grad" almost invariably turned up at the Department of Geology in the course of the trip to receive Dr. Miller's warm greeting and to feel the heartiness and sincerity of a man who had been so truly a friend of the sons of Lehigh and who had such happy faculty for making and retaining so many friends and for knowing intimately so vast a number of persons.

Dr. Miller was not a cloistered soul. Just as he became known in the educational institution that he adorned for so many years, so he became widely and favorably known throughout the community in which he lived and in the profession that he followed in connection with his educational activities.

It was said of him that no man knew so much about what underlies the Lehigh Valley. Throughout more than half his lifetime he moved over and explored this entire section of the State as a geologist and committed a very great deal of his findings to writings that are the authority for all who work in this field. Furthermore, by reason of his complete knowledge of geological conditions in this Valley, he became the source of information for every business concern and every individual who engaged in or expected to engage in any form of mining in this section. Thus his was the technical advice and information that were sought by the cement companies of the Valley during the era of their greatest growth and productivity. In the same manner, his was the advice that was sought by those who quarried slate, limestone, coal, and other mineral products while sadly, perhaps, his advice often was given to overzealous enthusiasts to refrain from spending any money in search for gold, copper, oil, and other precious minerals and mineral products because he knew their search would end only in complete disappointment and entire loss of any investment made in the search.

Wherever Dr. Miller was called in the course of his profession there he left a trail of friendship that persists to the present time. Likewise this was true in the field of his international operations, for he was widely known among the geologists of the world, had many opportunities to meet the greatest of them throughout years of international congresses and personal correspondence and wherever he moved left the impress of his wonderful personality.

Every circle that knew Dr. Benjamin L. Miller will keenly miss him and sincerely deplore his loss. Lehigh University, the scene of his best work and his largest group of contacts, especially will suffer through his passing.

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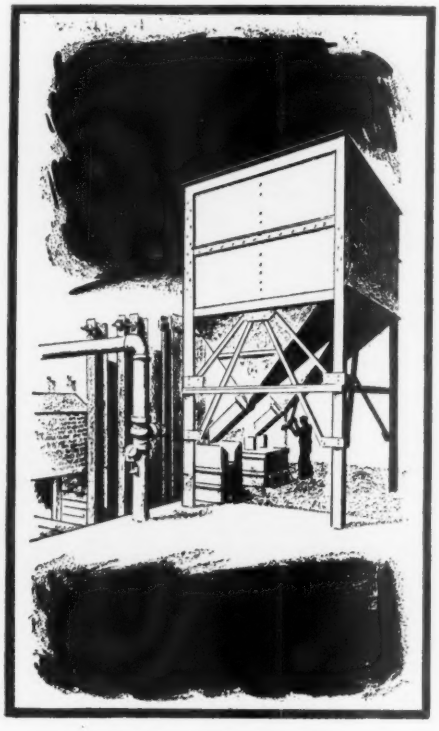

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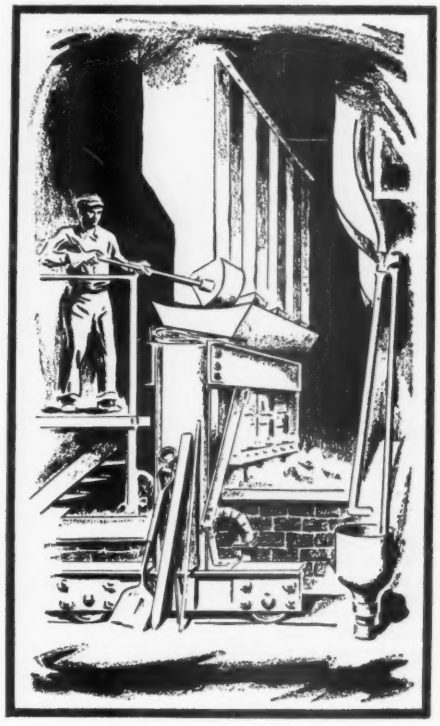

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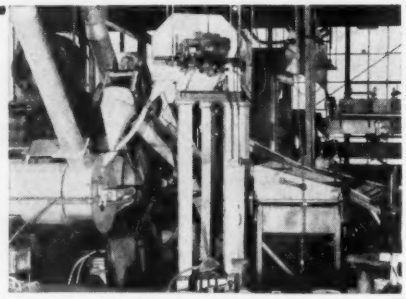

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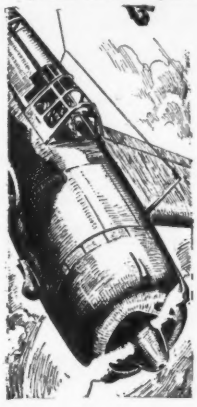

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